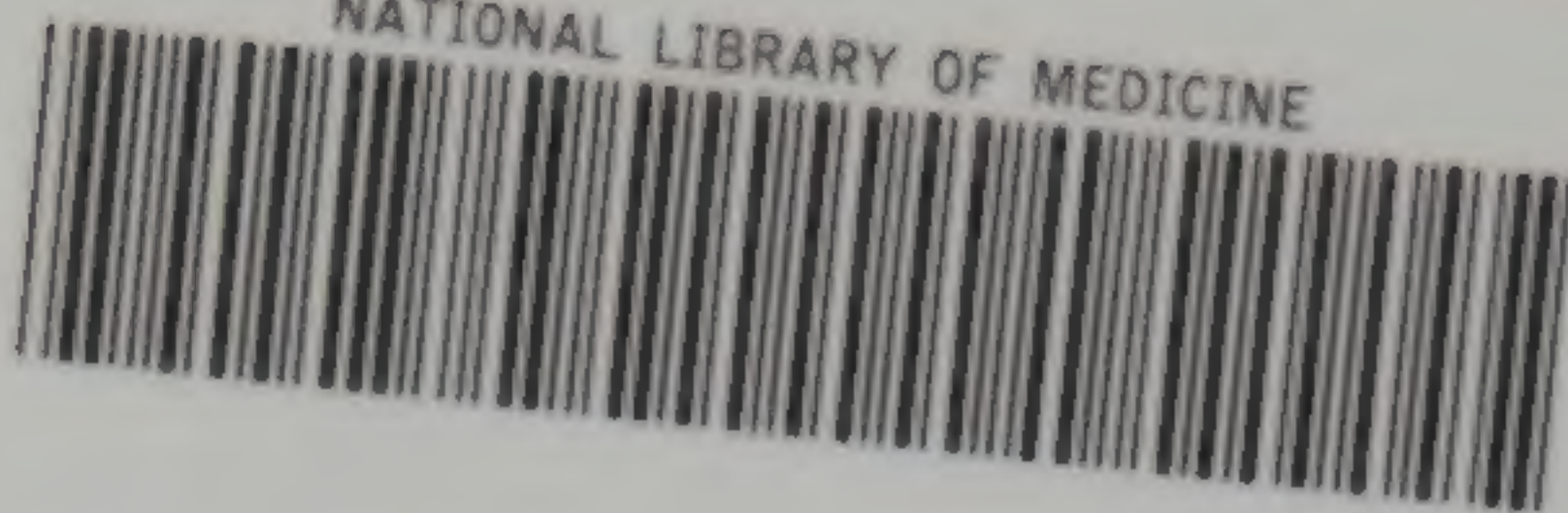


W P
G653r
1880

REPRINTS OF PAPERS
UPON
Gynecological **S**ubjects.

BY JOHN GOODMAN, M. D.

NATIONAL LIBRARY OF MEDICINE



NLM 00555649 2

1243
25804
SAMUEL D. GROSS LIBRARY

DUPLICATE
OF THE

Philadelphia Academy of Surgery.

College of Physicians
OF PHILADELPHIA.

College of Physicians

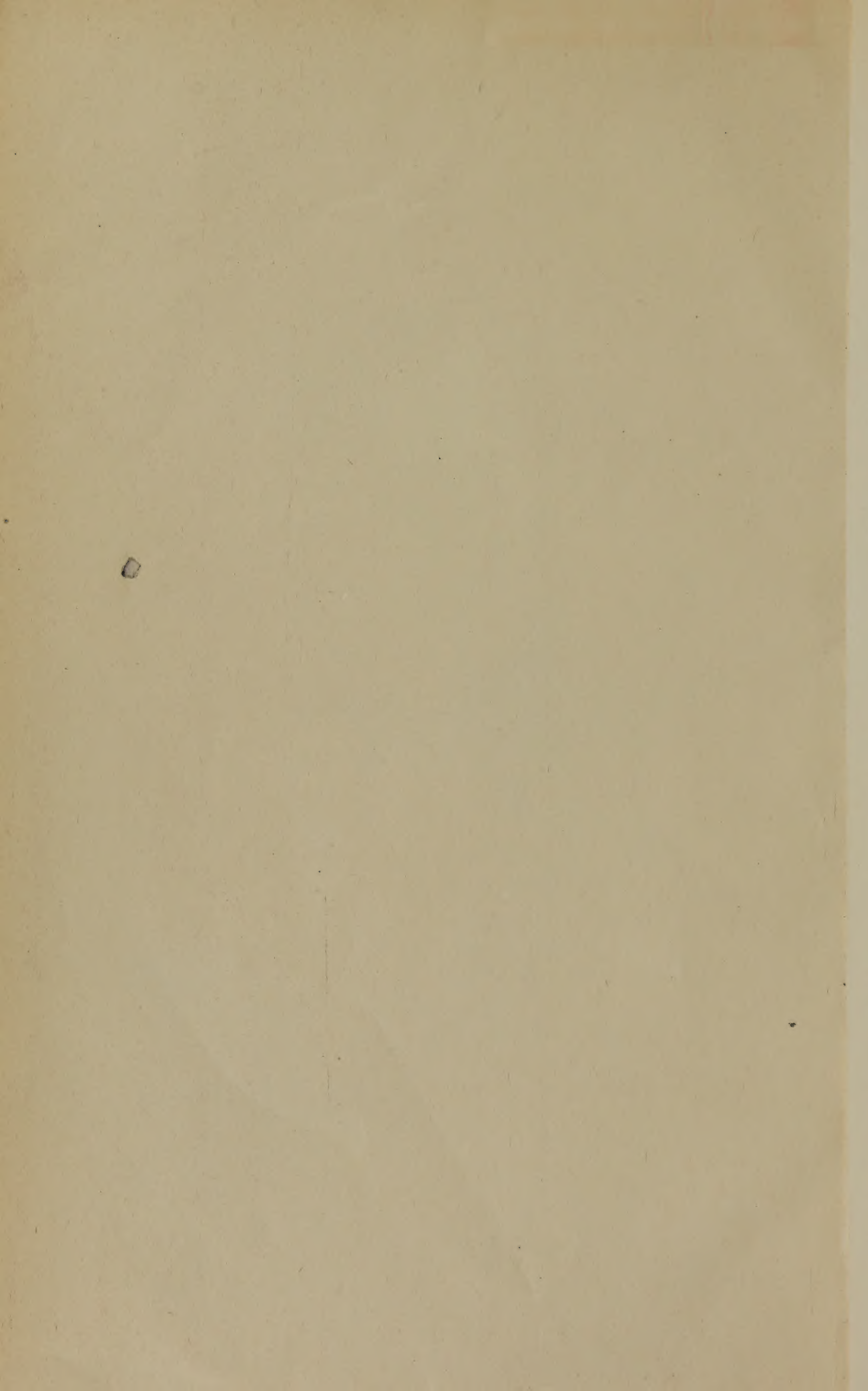
SURGEON GENERAL'S OFFICE

LIBRARY.

ANNEX

Section,

No. 116880



REPRINTS OF PAPERS
UPON
GYNECOLOGICAL SUBJECTS.

BY JOHN GOODMAN, M . D.,

PROFESSOR OF OBSTETRICS, LOUISVILLE MEDICAL COLLEGE,

LOUISVILLE, KY.
1880.



WP

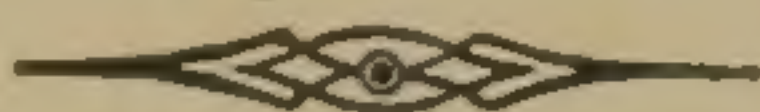
G.653r

1880

TREATMENT

OF CHRONIC CYSTITIS IN THE FEMALE.

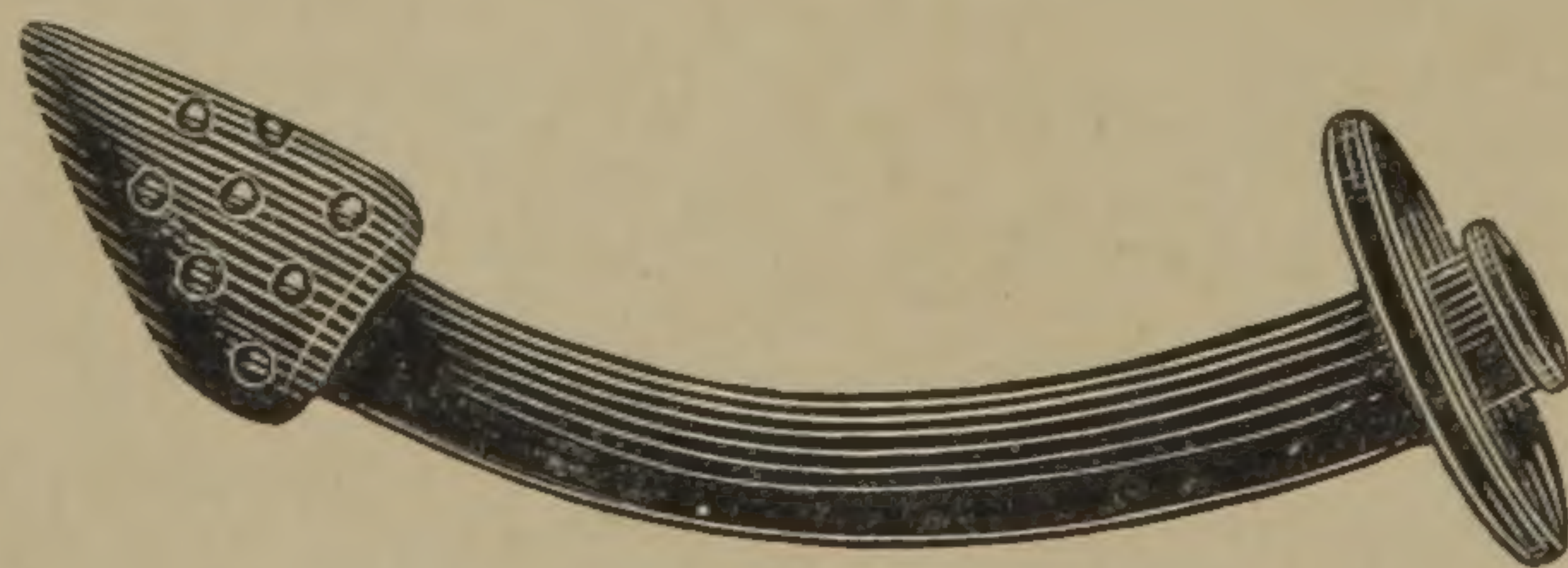
From the American Journal of Obstetrics, November, 1874.



As every experienced practitioner can testify, chronic cystitis is not only one of the most distressing of maladies, but also one of the most difficult to cure. From the nature of the functions of the bladder it is impossible, by ordinary means, to carry out the rational indications in the treatment of inflammation when the organ is diseased, that is, to remove causes of irritation and place the parts at rest. The excretory action of the kidneys being without intermission, urine is continually collecting within its cavity, and as soon as its walls are somewhat distended peristaltic movement is excited; moreover, the mucus acts as a ferment to the urea and converts it into carbonate of ammonia, which is highly irritatating to the inflamed surface, and the coats of the viscus becoming thickened and indurated, complete contraction is prevented, so that in spite of the agonizing efforts of the patient to get rid of the offending matter there is always a residuum of acrid fluid. The relief of these cases is utterly hopeless without drainage; this principal has long been recognized, the only problem being as to the best method of effecting it. It might be accomplished by the use of an ordinary or a Sims' catheter, but at the expense of protracted confinement to bed, which would be disastrous to the general health, and by weakening the powers of nature, might protract or prevent recovery.

To obviate this difficulty, some of our most eminent surgeons have advocated and practiced the establishment of an artificial *vesico-vaginal fistula*, through which the water could dribble away as fast as secreted. This measure generally cures the cystitis, although it entails upon the patient a grave and distressing lesion, which ultimately requires the performance of a painful surgical operation for its removal.

For the last five years I have been enabled to manage these cases with the greatest satisfaction, and to effect perfect drainage without inconvenience or danger to the patient or confinement to bed, by means of a self-retaining catheter of my own invention. This instrument was figured and described in the *Richmond and Louisville Medical Journal*, for Feb., 1869, in connection with the after-treatment in the operation for *vesico-vaginal fistula*. The following is the description there given, the measurements being slightly altered: It is about two inches in length and bent to correspond to the curvature of the urethra; at the lower or external end there is a button ten-sixteenths of an inch in diameter, and at the other or internal end a shouldered cup-shaped expansion, varying from five-six-



teenths to seven-sixteenths of an inch in diameter, beveled on the convex aspect of the instrument, in order to make it easier of introduction, and perforated with a number of small holes. The stem intervening between these two portions, is one and one-half inches

in length, and a quarter of an inch in diameter, with as large a bore as is compatible with the requisite strength. This catheter is self-retaining in all positions of the patient, first, by reason of the bulb at its upper extremity which passes beyond the urethra into the bladder; secondly, on account of its curved shape; and thirdly, in consequence of the button being overlapped and grasped, as it were, by the vulva." At the lower end there is a slight projection or knob, over which an india-rubber tube may be slipped; this being inserted into a bottle at night, or into a urinal when the patient is up, her person may be kept perfectly dry.

The accompanying case is only one out of a number that I have treated on the same plan. I have selected it, because it was the worst I have encountered, and serves to illustrate some of the difficulties we have to contend with, as well as demonstrates what may be accomplished.

CASE. Mary —, an Irishwoman, of scrofulous habit, 26 years of age, and unmarried, came under my care in June, 1871. She had suffered from chronic cystitis originating as she believed from cold, for about four years; for the last two years she had been a helpless invalid, incapacitated for any kind of work. During this time she had been treated by several physicians without material benefit. She was much emaciated with an anxious, worn expression, and suffered incessantly from vesical tenesmus which compelled her to pass the greater part of the time straining upon the vessel. The urine was always ammoniacal, loaded with mucus, and occasionally bloody. The bladder was so exquisitely tender that she was unable to contract the abdominal muscles sufficiently to stand erect, so that her only modes of locomotion, were upon all-fours

or in a stooping posture with her hands resting upon her knees. Dr D. S. Reynolds. of this city, who had recently been in attendance upon her, very kindly gave me a detailed account of the treatment he had pursued, from which it was evident that nothing was to be hoped for from medication or injections, for, as he truly remarked, he had tried every thing that had ever been found useful in such cases, except drainage; his idea being, to accomplish this by puncturing the bladder. Upon exploring the urethra, I found it implicated in the disease, and so contracted and sensitive that it was impossible for me to introduce the smallest of my self-retaining catheters; but being unwilling to abandon the hope of effecting drainage in this way, I substituted an exceedingly small catheter of the ordinary shape, and secured it *in situ* by means of cords; it produced such violent spasmodic pains, however, that I was compelled to remove it at the end of half an hour, and for the remainder of the day the urine, which had previously been simply turbid, was highly colored with blood. On the following morning I used the catheter again, for half an hour, and instructed the nurse to repeat the operation at noon, and at night. This course was persisted in for four days, the instrument remaining a little longer each time, until the fifth day, so much tolerance had been acquired that I administered an opiate, and directed that it should not be interfered with, except when she desired to have an action of the bowels. On the eighth day I substituted a Sims' catheter, a little larger than the first; and at the expiration of three weeks, this was, in turn, replaced by the smallest of my own instruments.

In this time, there had been no essential change in the patient's condition; she did not suffer so much from

straining, and could sleep better, but complained bitterly of the constrained position to which she was restricted, as it was necessary for her to lie upon her back, that the urine might be received upon cloths and sponges placed between her thighs. Several attempts were made to fix a tube to the instrument, but there was so much leverage to the Sims' catheter that it gave her pain, and the straight one was invariably pulled out. When my catheter was introduced, I wanted her to get up and go about a little, but she was still unable to stand erect, on account of the soreness in the hypogastrium. An india-rubber tube, four inches long, was attached, by which the urine was conducted into a bottle, and she could turn upon her side; in this way her comfort was greatly promoted. In two months her appetite had returned, she slept well, had little or no spasmodic pain, and all febrile excitement had subsided. I now introduced a catheter with a larger bulb, as the other had occasionally slipped out when her bowels were moved, and insisted upon her taking some exercise. With a view to keeping her dry when up, she was provided with an ordinary rubber urinal, which was strapped to the leg.

From this time improvement steadily progressed. She soon learned to remove and re-introduce the catheter herself, so as to be of no trouble to any one. Very little medicine was given; occasionally she was compelled to take an opiate, and at intervals I prescribed a tonic. At the end of four months, she could stand erect, and was able to be on her feet the greater part of the day. In six months, she could do light household work, was free from pain, and the urine had returned, very nearly, to its normal state. She wore the catheter altogether about twenty months, for the last four

or five of which, however, I regarded it as unnecessary; but she clung to it as her best friend, and when she did give it up, it seemed to be with reluctance, as well as with apprehension. Nearly a year and a half has now elapsed since all treatment was suspended, during which, she has been engaged in ordinary domestic duties, such as cooking, washing and house-cleaning, and I have every reason to believe is permanently cured.

It occurred to me in connection with this case, that the maintenance of the bladder for so long a time in a collapsed condition, might lead to a permanent diminution in its capacity; and I was several times tempted to resort to occasional injections of tepid water, with a view to preventing it. But it would have been useless trouble, as she assures me, that she has been able to retain her water for as long a time since her recovery as she ever could, generally passing it five or six times in twenty four hours.

I do not always find difficulty in establishing a tolerance of the catheter; in some instances where the urethra has not been involved, I have introduced one of the largest size at the outset, without confining the patient to bed for a single day. In one case the relief from tenesmus was instantaneous and complete.

It will sometimes be found, that although the instrument is well borne when the patient is recumbent, it will produce pain when she is erect. This is due to too great a curvature in the stem, causing the point to press against the anterior wall of the bladder. It may be easily straightened when the material is hardened rubber, by dipping it for a moment in boiling water.

It is never absolutely necessary to remove the catheter for the purpose of cleaning it, oftener than once in three or four days; although I am in the habit, when

the treatment has been thoroughly inaugurated, of furnishing the patient with two instruments, to be worn alternately one or two days at a time, the one not in use being submerged in acidulated water to remove incrustations.

My experience in this method of treating chronic cystitis in the female, leads me to the conclusion, that *any* case uncomplicated by disease of the neighboring viscera, or serious constitutional dyscrasia, may be cured by drainage, unaided by local or general treatment. And in this I am sustained by the experience of others. In the April number of the *Virginia Medical Monthly*, there is a very interesting case reported by Dr. Hunter McGuire, in which drainage was achieved by means of an india-rubber tube; four or five inches of the tube were pushed through the urethra into the bladder, and notwithstanding this large amount of foreign matter within the cavity of the organ, the cure was rapid and complete.

A NEW METHOD OF CONDUCTING THE AFTER-TREATMENT IN THE OPERATION FOR VESICO-VAGINAL FISTULA.

(*From the Richmond and Louisville Medical Journal, February, 1869.*)

The ordinary method of conducting the after-treatment in the operation for vesico-vaginal fistula, is not only a great tax upon the time and patience of the medical attendant, requiring, as it does constant watching that the catheter may not become clogged, or some other accident happen, calculated to interfere with success, but is also exceedingly irksome to the patient, on account of her being compelled to remain recumbent for so long a period, and the great liability there

is, in spite of the utmost care, to her person becoming wet and excoriated from the dribbling of urine. Fully convinced, by experience, of the importance of these objections, I have been led to seek for some expedient by which they may be obviated, and at the same time, the essential indications for cure be fulfilled.

The cardinal point in the management of these cases is, in my opinion, *to keep the bladder empty*. When this is effectually done, not only are the lips of the wound prevented from being torn assunder by distension, and the muscular activity of the parts subdued, but the organ being collapsed and entirely within the pelvic cavity, is removed from the influence of extraneous agencies and is very little, if at all, affected by movements of the trunk or lower extremities upon the pelvis. Hence I can see no valid reason for prohibiting all exercise and confining the patient to bed, provided this condition of the bladder can be otherwise maintained. I believe it would suffice, simply to dilate the urethra, thoroughly, with sponge tents before the operation; but as there is some risk of this giving rise to troublesome or even permanent incontinence of urine, I would prefer to use a catheter, and have had one constructed, for this purpose, upon the following plan; [*See previous article for description of instrument.*]

It is designed, in accordance with the foregoing views, to be placed in position immediately after the operation; and as soon as the patient feels able to do so, she is to be permitted to sit up and take moderate exercise *ad libitum*. In this way, she will not only be rendered in all respects as comfortable during the after-treatment as she was previously, but her general health and strength will be preserved, and at the expiration

of the time usually allotted to the remaining-in of the sutures, if union has not taken place, only a few days need elapse to allow the local swelling and inflammation to subside, before another attempt at closure may be made; thus, doing away with those long delays of five or six weeks, heretofore considered necessary between successive operations.

Other advantages possessed by this instrument may be enumerated as follows: Being much shorter than those in general use, it does not irritate the bladder to the same extent and is not liable to become obstructed by mucus or blood clots. It is entirely inclosed by the parts and its temperature is maintained at that of the body, consequently, there is comparatively little deposit of saline matter, within or upon it; in fact, I have never found it necessary to remove it, on account of incrustations, oftener than once in every seven days, and sometimes it may remain even longer than this. There is no danger of its slipping out of place, while the patient is asleep. It may be worn, without causing the slightest uneasiness. for any length of time after the removal of the sutures in a successful operation, in order to prevent undue strain upon the recent cicatrix. Its use does away with all occasion for haste, in removing the stitches. Lastly it is calculated, I believe, to greatly extend the applicability of caustics in the treatment of vesico-vaginal fistulæ. There can be no doubt, that contraction and closure, of an opening of this kind would be more certainly effected by repeated cauterizations, if in the meanwhile, the bladder was kept empty and the urine prevented from passing over the healing surfaces; but no one, at the present day, would entertain the thought of confining a patient to bed, in order to drain off the urine through the urethra,

by means of an ordinary catheter while this treatment was being pursued. This instrument, however, will accomplish the same object without inconvenience or the necessity of confinement; and, I am strongly persuaded, that, used in conjunction with caustics, it would suffice for the relief of fistulæ, even of some magnitude. I have not had occasion to put this plan to a practical test, and possibly may never have, for I can hardly imagine a case in which I would not prefer the more certain and speedy method of cure, by operation, but I think that any practitioner, if not prepared to operate, would be justified in trying it, whenever the circumstances of the sufferer rendered it impossible for her to seek aid at a distance.

In the use of this, as of all other surgical appliances a great deal must, of course, be left to the judgment and ingenuity of the operator. Made according to the measurements given above, it will be adapted to most cases but, as the urethra varies somewhat in distensibility in different individuals, or may be implicated in the injury or contracted from disease, it will be found necessary, occasionally, to modify it, both in size and shape, to meet special indications. In one instance, I employed satisfactorily, a simple curved tube, two inches in length, with a button on the lower end, which was kept *in situ* by a perineal bandage.

It is always advisable to select a catheter several days before the operation, and allow the patient to wear it, both for the purpose of ascertaining its retentiveness and of accustoming the parts to its presence. I generally caution her to notice it, and if there is any tendency to misplacement, I instruct her to push it back gently with her finger; although I have never had any trouble in this respect, when the urethra has been suffi-

ciently healthy, to admit of an instrument being used with a bulb, three-eighths of an inch in diameter.

The following cases will serve to illustrate this mode of treatment:

CASE. Mrs. M., an intelligent lady, 32 years of age and of sound constitution, came under my care for vesico-vaginal fistula, resulting from prolonged retention of the head and shoulders in breech-labor two years before. Three operations had already been performed for her relief by one of the most experienced surgeons in the country, with only partial success; after each of which, being quite fleshy, she had suffered much from the confinement. Upon making a preliminary examination the fistula was found to be situated at the apex of the vagina, and sufficiently large to admit the first joint of the index finger: its proximity to the anterior lip of the os uteri had evidently been the cause of the failure on former occasions, as it rendered it difficult to maintain the coaptation of its edges. A catheter with a bulb four-tenths of an inch in diameter, was next introduced; it proved to be perfectly retentive, but excited some vesical tenesmus and was consequently allowed to remain for the two succeeding days, by which time the bladder became reconciled to its presence. I would remark, in passing, that I have often seen these spasmodic contractions excited by the introduction of an ordinary catheter, and I consider it one among the chief recommendations of this instrument, that it can be worn until tolerance of it is acquired, previously to the operation.

On the 24th. of November, 1868, I operated in the presence of Prof. H. Miller and Dr. R. F. Logan. Nothing worthy of note occurred during the operation

which was performed after the method of Sims, eight sutures being necessary to bring the lips of the opening together. The catheter was then replaced and the patient furnished with a wire, looped at one end and of just sufficient length to reach to the upper extremity of the bulb, which she was directed to pass into it, three or four times a day to insure its perviousness; and permission was granted her to sit up or walk about the room at will. Being very much fatigued by the operation, she did not avail herself of this privilege, until late in the evening, when she sat up an hour. On the following day she was up two hours in the morning and three in the evening; and after this, from six to eight hours in every twenty-four. Her bowels were restrained by opiates, and occasionally, when the secretion of the urine seemed to be scanty, a few doses of sweet spirits of nitre were administered, with a view to diminishing, as much as possible the deposition of the salts within the catheter. On the eighth day the catheter was removed and cleansed for the first time, and subsequently, during the four weeks that it was used, it was not changed more than once in six days.

I had fixed upon the tenth day for the removal of the sutures, but was compelled to postpone it until the twelfth on account of cloudy weather and bad light. On the 16th. of December, three weeks after the performance of the operation, I instituted a critical examination, assisted by Prof. Miller and Dr. Satterwhite, with a view of determining, definitely, the result when it was ascertained that complete union had taken place.

Throughout the after-treatment, the patient was perfectly comfortable, and her general health was as good at the close as it was at the outset.

MENSTRUATION

AND THE

LAW OF MONTHLY PERIODICITY.

From December No. Richmond and Louisville Medical Journal, 1875



The occurrence of a sanguineous flow from the genital organs of women at the period of puberty, and its recurrence thereafter at intervals of a lunar month for thirty years, unless interrupted by pregnancy, lactation or disease constitutes a phenomenon sufficiently strange to excite wonder, and to stimulate inquiring minds to its investigation. Accordingly, from the days of Hippocrates to the present time, attempt after attempt has been made to solve the problems of its causation and periodicity. To the modern physician, such questions are not simply matters of laudable scientific curiosity, but have a direct bearing upon the pathology, diagnosis, and treatment of female diseases. Thus far, physiologists have not been able to answer them in a definite manner, and, baffled in their search for facts, have contented themselves with the fabrication of theories. These have varied in character from the grossest superstitions to the most subtle refinements of scientific ingenuity; but in this connection it is unnecessary to enumerate even the most plausible, for

there is only one that is now regarded with any thing like general favor. This is the *ovular theory*, which assumes that menstruation is due to the periodic discharge of ovules from the Graafian follicles. Intimately associated in its origin with the discovery of an important physiological law,* and ably advocated by high authorities, it has come to be received by the Profession at large as demonstrated and established; and for the last twenty years has exercised a decided influence in modifying our views on practice. But to my mind it is unsatisfactory, and I will proceed in as brief a manner as possible to assign the reasons.

It is necessary, however, in the outset, to obtain a distinct enunciation of the theory in question, that we may understand the extent and nature of its claims; and instead of expressing this in my own words, it is certainly fairer to accept it as set forth by some of its most intelligent advocates. In looking over the various authorities for explicit statements of this kind, I find the language of many so ambiguous that it is impossible to determine exactly what opinions they hold. But there are some who entertain definite ideas and are capable of expressing them accurately. By these, the ovular theory is presented to us under two phases, the one simply maintains that the regularity of menstruation is dependent on the regularity of ovulation; the other goes a step further, and prescribes a cause for the periodicity of ovulation. The first is the form in which it is adopted by Cazeaux, as these extracts from his "Treatise on Midwifery" will serve to show.

"After having read all that has been written on the subject, the mind rests entirely satisfied in its ability to refer this singular phenomenon to one unchangeable and easily verified fact; namely, the successive evolution of Graafian vesicles." (Second Am. edition, p. 91)

"Menstruation is, therefore, intimately connected with the evolution

* The law of spontaneous ovulation.

of the ovarian vesicles, and can not occur without it; and every time that it appears, we may feel satisfied as to the existence of a vesicular development." (Page 92.)

"Why is it that ovulation in the human species recurs about every month? To this question science is unable to reply, for it is probably one of the impenetrable mysteries of nature." (Page 93.)

Of the second phase, our own countryman, Dr. Meigs, is probably the most lucid expounder. His views are fully elaborated in his *System of Midwifery*; but the following passages, the one from his work entitled *Woman and Her Diseases*, and the other from a note to his translation of *Columbat on Diseases of Females*, are more concise.

"A healthy woman matures and deposits an ovum every twenty-eight days from the age of fifteen to that of forty-five years, failing only in pregnancy and lactation, and sometimes not even then. She sometimes suffers an arrest of the force during lactation, yet in the majority even that arrest is of short duration; and in many it does not take place at all. The closing stage of maturing and depositing or discharging the ovum is attended with a discharge of bloody fluid from the genitalia, which is called menstruation, because it takes place once a month. That bloody fluid exudes from vessels on the inner aspect of the womb, which has become engorged in common and along with the ovary, and which, by this discharge, is relieved of its hyperæmia."

"The question as to why it (ovulation) should have so exact a periodical character, is no more difficult of solution than that of the stated periods of eruption of the first and second dentition, the growth or fall of the hair on the head," ect.

All this seems very plain and easy to be understood, and I admit would be so if there was only one ovary. There are two of these bodies, however, equally concerned in the elaboration of ovules; but numerous observations have shown that, as a rule, only one Graafian vesicle is ruptured at a menstrual period. The question then very naturally arises, How do the ovaries divide the work between them? What is their rhythm of action? One of the two things must be the case, they must alternate month by month, first one and

then the other maturing an ovule, or each must remain in functional activity for two or more consecutive months while the energies of the other are in abeyance. Mr. Girdwood seems to have entertained the former idea, as he claimed to have met with cases in which women have menstruated a certain number of times, and after death a corresponding number of cicatrices were found upon the ovaries, equally distributed between the two. In either event the removal of one ovary should affect the periodicity of menstruation. If the first supposition were correct, it would take place thereafter bi-monthly; if the second, it would be rendered irregular. But nothing of this kind ever happens. Innumerable instances are on record, in which, after the extirpation of one ovary, menstruation has continued in the ordinary manner.

Here, then, we encounter a serious obstacle to our acceptance of this theory at the very first step. I am fully aware that its friends might attempt to bridge over the difficulty by a simple and ingenious hypothesis. They might say that when one ovary is removed the other takes on compensatory action and does double duty, just as when one kidney is removed the other assumes its functions and excretes as much urine as was previously excreted by both.

To the disciples of Dr. Meigs, I would reply that this is an impossibility, for the time of ripening and rupture of each Graafian vesicle is preordained from the birth of the individual, as much so as the "periods of eruption of the first and second dentition," ect. To the other faction I would answer somewhat more at length. In the first place I would deny the justness of the analogy, for the ovary is not a gland in the ordinary acceptation of the term* it neither secretes

* Dalton's Physiology, p. 534.

nor excretes. The rudimentary ovules exist in the embryo, and the ovaries merely afford a nidus within which they are matured. Suppose the analogy were insisted upon; is it not reasonable to believe that some additional development would be necessary in the remaining ovary to enable it to accomplish its task? This would require time for its completion, and in the meanwhile we would expect menstruation to be irregular, whereas, experience tells us that single ovariectomy does not interfere with the menstrual function any more than other grave surgical operations.

It has been justly urged against this theory, that it is not fully sustained by the results of post-mortem examinations. If menstruation is secondary to and dependent upon ovulation, then in *every* instance in which a woman dies during or after the menstrual period, we should be able to find evidences of the recent rupture of a Graafian follicle. But several observers* have encountered cases in which no such evidences could be detected. In evasion of this objection, it is claimed that the vesicle may proceed in its development up to the final stage, when without rupturing, it excites the menstrual congestion, and then aborts or undergoes a process of atrophy.† As Tilt has said, this is a virtual abandonment of the whole theory. At best it is a mere assumption, for what proof could we possibly have of the maturation of a vesicle except its rupture?

On the other hand, ovulation may be accomplished without causing menstruation, as it is shown by the frequency of conception in nursing women, when menstruation is suspended, and in young women who have never menstruated. Furthermore, it is quite certain

* Coste, Ritchie, Ashwell, Paget, Bischoff, Williams and others.

† Caseaux, p. 81.

that ovulation takes place in some persons more frequently than menstruation; that is, it happens not only at menstrual periods, but during the interregnum. This would be inferred from the possibility of impregnation at this time, and has been ascertained to be a fact by actual observation.*

The most conclusive of all testimony against the ovular theory of menstruation has been furnished by the results of recent operations of double ovariectomy. We now know that a woman, after this operation, may menstruate for years; in fact up to the ordinary climacteric age in a perfectly natural manner, "as to time, quality and quantity."

In order to determine as accurately as possible the effects of the removal of both ovaries upon the menstrual function, I have carefully examined and arranged in the accompanying table all the cases of which I could obtain reports. In every instance in which no mention is made of subsequent menstruation, I have taken it for granted that it did not occur, and irregular sanguineous discharges I have, of course, not counted as menstrual.

Of the twenty seven cases here recorded, it will be observed that in nearly half, menstruation was not affected by the removal of the ovaries; in one the hæmorrhagic discharge was increased (3); in one it was diminished (7); and in several sanguineous flows occurred at irregular intervals (24 and 27).

[Since the original publication of this article, I have obtained reports of nine additional cases; three by Thomas, three by Batty, one by Trenholme, one by Kimball and one by Bryant. In three of them the subsequent history was not given, the reports having been made immediately after the operation; in two menstruation was arrested; in one it recurred three times at the usual intervals and then ceased, and in three, among which was a case of vicarious menstruation, it was not affected.]

*Ritchie, *Lon. Med. Gaz.*, 1844. p. 138, case 4.

TABLE OF CASES IN WHICH BOTH OVARIES HAVE BEEN SUCCESSFULLY
REMOVED FROM WOMEN UNDER FORTY-FIVE YEARS OF AGE.

No.	Operator.	Quoted from	D'te	Age	
1	Pott.....	.....	178-	23	
2	J. L. Atlee.....	A. J. Med. Sci., 1844.....	1843	29	
3	Bird.....	Lancet, 1848.....	1847	32	Menstruation uninterrupted; tendency to mennorrhagia.
4	Peaslee.....	Lyman's Table.....	1850	24	
5	Burnham.....	Lyman's Table.....	1853	42	
6	W. L. Atlee.....	Atlee on Ov. Tumors.....	1854	35	Menstruation regular. Ceased in 1864, 45th year.
7	W. L. Atlee.....	Atlee on Ov. Tumors.....	1855	19	
8	W. L. Atlee.....	Atlee on Ov. Tumors.....	1861	40	Regular menses with white discharge. Menstruation regular to 1863, when last reported.
9	Peaslee.....	A. J. Med. Sci., 1863.....	1862	35	
10	Peaslee.....	A. J. Med. Sci., 1864.....	1863	39	
11	W. L. Atlee.....	Atlee on Ov. Tumors.....	1864	34	Last report 1870. Menstruation regular to that time.
12	Beatty.....	Wells, Dis. of Ovaries...	1865	37	
13	Storer.....	A. J. Med. Sci., 1868.....	1866	.....	Menstruating regularly a year after operation.
14	Storer.....	Peaslee on Ov. Tumors..	1867	43	
15	Wells.....	Wells, Dis. of Ovaries...	1868	39	
16	Wells.....	Wells, Dis. of Ovaries...	1869	22	
17	Hicks.....	Wells, Dis. of Ovaries...	1869	39	
18	Munro.....	Wells, Dis. of Ovaries...	1870	34	
19	Mayer.....	Wells, Dis. of Ovaries...	1871	29	Last report one year after oper- ation. Menstruation regular.
20	Meadows.....	Lancet, 1872.....	1871	.....
21	Priestly.....	Wells, Dis. of Ovaries...	1872	22	Last report six months after op- eration. Menstruation regular.
22	R. A. Jackson.....	Peaslee, Ov. Tumors.....	1865	44	
23	Le Fort.....	Peaslee, Ov. Tumors.....	.....	.....	*Continued to menstruate to the 47th year of her age. Menstruation regular.
24	Baker Brown.....	Peaslee, Ov. Tumors.....	.....	.....	Menstruates, but not regularly.
25	Baker Brown.....	Peaslee, Ov. Tumors....	.....	.....	†Menstruates regularly from cica- trix and vagina.
26	Koeberle.....	Peaslee, Ov. Tumors.....	.....	.....	Menstruation regular.
27	Batley.....	Personal Information....	1872	23	Irregular sanguineous discharges sometimes profuse.

Clay, of Manchester, had four cases in which there was subsequent sanguineous discharge.—
(Peaslee.)

* “Her regular monthly period had ceased the day before the operation. A flow per va-
ginam recurred thirty days afterward, and continued four days, with the usual symptoms of
lassitude, nervousness, and backache. It again appeared after an interval of eighty-three
days; and after this time it recurred with perfect regularity every twenty-eight or twenty-nine
days for twenty-two months accompanied by all the ordinary symptoms of menstruation, and
lasting each time from three to five days; it then ceased for four months to reappear for the
last time; the patient being now forty-seven years of age. During all the time, the patient’s
health was excellent, and Dr. Jackson satisfied himself that there was no disease of the uterus
or vagina.

† The whole uterus, except cervix, removed with ovaries.

The only explanation that can be offered by those who still adhere to the ovular theory of this persistence of menstruation, is that it is due to the force of habit. Yet in case No. 22 the function was suspended for three months at one time, which we would suppose should have been sufficient to have broken up the habit. But such an explanation is unscientific, as well as unsatisfactory; in fact it is no explanation at all. Habit may be defined to be a faculty or a proneness for the performance of any act in consequence of its frequent repetition, and may for our present purpose be divided into two classes, entitled respectively habits of aptitude and habits of recurrence. A habit of aptitude is simply a faculty acquired by practice, as when we say, "this man sleeps soundly in spite of the noise, because he has acquired the habit of doing so." Our so called habit of menstruation belongs to the second class. The most familiar example of this is the habit of "regularity of the bowels." It is well known that if a person will persistingly solicit a movement of the bowels daily at a fixed hour, in the course of time he will experience an inclination to go to stool regularly at that hour. This is said to be the result of force of habit. Let us investigate the subject, and see if we can not arrive at a more accurate understanding of it. The enforced regularity engenders a healthy state of the bowels, promotes its secretions and peristaltic action, and restores its nervous sensibilities to a normal condition; the rectum being each day subjected to about the same distension before it is evacuated, acquires a tolerance for the presence of a certain amount of fæcal matter, and after awhile whenever this quantity has accumulated, an impression is made upon the nerves of the part and transmitted to the sensorium. It might still be said that it is the nerves which have

acquired a habit of responding to a given degree of irritation. True, but this is a habit of aptitude, not a habit of recurrence; no one would pretend to say that a sensation would be experienced if there were no fæcal matter in the rectum. Here then, is a habit analyzed and rationally explained; and all habits of recurrence may be treated in a similar way and attributed to some antecedent cause or causes. This fact has long been recognized in mental philosophy, some writers considering all habits in which a mental process is concerned as the result of an association of ideas.* Thus, we perceive, the word habit is used either as a short way of expressing a complex series of acts, or as a cloak to cover our ignorance in obscure cases. There must be a cause for menstruation after the removal of the ovaries. Is it not probable (yes, I may say certain,) that it is the same cause which existed previously? The ovaries being wanting, there are no vesicles to rupture. The logical conclusion is, that the periodicity of menstruation never did depend upon the discharge of ovules.

This conclusion can not be disputed if our premises are admitted. We have proceeded upon the hypothesis that the Graafian vesicles exist only in the structure of the ovaries, and that the ablation of the latter would necessarily involve their removal from the economy but this point deserves some consideration. Spencer Wells remarks:† “The ovaries are usually two in number; not necessarily so, for their essential elements may be dispersed between the layers of the peritoneum, as in the lower animals. Ovisacs or Graafian vesicles have been seen developing in some of the mammalia at a distance from the entire ovary.” In another place he speaks of the development of vesicles thus situated

* Dugald Stewart.

† Diseases of the Ovaries, p. 11.

into unilocular tumors. Savage says nothing on the subject himself, but gives the following obscure quotation from Sappey;* "It is not a rare circumstance to find on the alar mesentery, especially 'round about the ovary, ten, fifteen, twenty, or more even, cystic ovules, some of them the size of a pea. Such ovules having failed to reach their destination, owing to some abnormal relations on the part of the Fallopian tube.

I have looked through all the writings at my disposal, and conferred with several anatomists and physiologists, to obtain definite information on this subject, but without success; and my own limited investigations on the cadaver have resulted negatively. No observations would be of value unless accompanied by a microscopic examination, in order to determine by the detection of the ovules whether small cysts found in this locality were truly Graafian follicles. In the ordinary operation of ovariectomy, a considerable portion of the broad ligament contiguous to the ovary constituting the pedicle, is excised. In Baker Brown's case (No. 25), the whole uterus, except the cervix, was removed with the ovaries. Storer reported a case in the "American Journal of the Medical Sciences," 1868, in a woman forty-seven years of age (consequently not included in the table), from whom he removed the uterus and both ovaries. Yet on the eighteenth day after the operation and the twenty-sixth day after the last appearance of the catamenia, "there occurred a sanguineous effusion, attended by feelings of backache lassitude, ect., lasting thirty hours, and being an evident attempt at the reestablishment of menstruation".

I think it a very fair conclusion, that if such vesicles really existed, they were totally extirpated in some, if not in the greater part, of the thirteen cases in which

* Savage on the Female Pelvic Organs.

menstruation continued after the removal of both ovaries. Even if some of them remained, it is clearly impossible that they could have been sufficiently numerous to have afforded a ripened vesicle every month for ten or more years. Their only effect would have been to stimulate the nervous system and maintain in a more perfect degree its ovarian development.

The foregoing objections are only a tythe of those that may be offered to the ovular theory of menstruation, but they are enough to compel me to reject it. It must not be inferred, however, that I deny all influence to the ovaries in determining the menstrual function. Observation has conclusively demonstrated that the presence of mature Graafian follicles within the organism of the individual is absolutely necessary for its primary establishment; for, in every instance in which the ovaries have been congenitally absent, or artificially removed before the period of puberty, menstruation has failed to take place. The ripening of the germ cells exerts an influence upon the female economy generically similar to but specifically different from that which the ripening of the sperm cells has upon the economy of the male. The evolution of spermatozoa by the testes reacts in some mysterious manner upon the nervous system and determines characteristic changes in distant portions of the body, especially the development of the larynx and the growth of hair upon the face. So in the female the maturation of ova creates an erethism of the nervous system that results in structural changes throughout the entire organism, the minute ramifications of which we can not trace, but its grosser manifestations are seen in the expansion of the pelvis, the enlargement of the breasts, and the increase of the adipose tissue. The power to develop hair upon the face may be considered an inherent

power of the economy, since rudimentary hair bulbs preexist in that locality; and the same may be said with reference to the power to develop the larynx, the pelvis, the breasts, and the adipose tissue; the state of the generative centres simply calling these powers into play. Sometimes in consequence of disordered states of the generative organs, this synergy of the nervous system is perverted from its usual channels, and other innate powers are aroused. A marked case of this kind is reported in the "London Medical Gazette" for 1843-4, in which suppression of menstruation, due to an acute affection of the ovaries arising from exposure to cold, was followed by a growth of hair over the whole surface of the body. Is it not a legitimate inference that *the Law of Monthly Periodicity which dominates the menstrual function is also inherent in the animal economy, and is simply stimulated into activity by the ovular erethism?*

When once the physical modifications referred to have been induced at the period of puberty, the subsequent removal of the testes or ovaria does not necessarily cause them to recede. Sometimes there is a tendency to a return to a neutral type, as was evinced in Pott's celebrated case, where after the removal of both ovaries, the voice became coarser, the form more angular, ect. On the other hand, after many of the operations of double ovariectomy, no loss of womanly attributes has been noticed; and almost every surgeon is familiar with cases of castration of men where the voice and personal appearance have remained unchanged. If, then, the manifestation of the Law of Periodicity has an origin in common with the physical alterations—that is, depends on the same condition or development of the nervous system—we would expect

that it would exhibit an equal tendency to permanency after the withdrawal of the primary exciting cause. In this way alone can we account for the persistence of menstruation after the removal of the ovaries.

To what extent does this law prevail? Is it an essential, all pervading principle of life, under ordinary circumstances accomplishing its work without external signs? Or is it a dormant energy of the system, which is only exerted in order to accomplish a specific purpose? If it were the first, we would expect to see it occasionally displayed in the male subject. It is true, instances of this kind have been reported, but all of them will be found, upon investigation, to be open to charges of error. In the "American Journal of the Medical Sciences" for 1853, there is an account of a being who, in all external appearances, seemed to be a man, in whom menstruation occurred regularly from the urethra. After death, an examination revealed the fact that the creature was an hermaphrodite. In the same journal for 1867, there is another case, in which a young man is said to have experienced a monthly sanguineous flow from the glans penis. Such cases, even admitting their authenticity, are incomplete without a post-mortem examination to demonstrate the absence of the ovaries. There is still another class of cases in which the symptoms are too vague and shadowy to deserve notice. In short, there is a total absence of positive proof that periodic phenomena of a monthly type are ever present in the human male.

The statement of naturalists with reference to periodicity among the lower animals is very unsatisfactory. This is due, in part, to the fact that most of them being converts to the ovular theory, have regarded menstruation and œstruation as analogous.

According to Saint-Hilaire, menstruation occurs in several species of monkey every month and is exactly similar to the process in the human female. Dr. John Percy, of Birmingham (quoted by Girdwood), says he has had constant opportunities of observing the female mandrill and drill during four years. "At intervals of *about six or eight weeks*, the labia become uncommonly distended, red, and shining. The swelling proceeds gradually and attains its maximum in about five days or a week. It then gradually declines and a quantity of sanguineous discharge makes its appearance, generally, though, so far as I have observed, not uniformly." Dr. Girdwood maintained that each genus of the mammalia has its own catamenial cycle, and endeavored to determine them chiefly by a microscopic examination of the vaginal discharges. To a rabbit, he assigned ten days; to the mare, a fortnight; to the cow, three weeks; to the dog, twelve to sixteen days, and so on. All that can be deduced from such testimony is, that if there are periodic phenomena among the lower animals, they are confined to the female sex, and are, as a general rule, of a different type from those observed in the human species. I would, therefore, conclude that the Law of Monthly Periodicity is not an essential element of organic life, and is inoperative, except in the human female, and possibly in the females of some of the higher mammalia, where it subserves a special purpose in connection with the process of reproduction.

Let us next inquire somewhat more closely into the nature of this law. "Laws of animal nature," says Webster, are "the inherent principles by which the functions of animal bodies are performed." These principles are not always primary in their character,

but are, as a rule, resultants of antecedent acts which take place with sufficient precision to establish the principal or law for the government of the consequent function. The Law of Monthly Periodicity is that which governs and determines the periodic return of menstruation and its attendant phenomena, and must necessarily be the result and exponent of certain changes or series of changes that transpire within the organism in recurring cycles; these cycles being uniform in their duration, definite in their manifestations, and common to woman-kind. The essence or factor of the Law, then, is a dynamic cycle of physiological acts. But in what part of the system does this cycle revolve? Where is the seat of these changes?

Not in the ovaries, as Tilt supposed, for their annihilation does not always arrest the action of the law.

Nor in the uterus, for women in whom this organ has been congenitally absent, have experienced unmistakable signs of monthly periodicity.

Paracelsus, DeGraff and others referred the process to changes in the composition of the blood. Nature has negatived such theories by presenting us with the Hungarian Sisters, in whom the blood-vessels were united at the loins, giving them a common circulatory fluid, yet their menstrual periods were different.

Tyler Smith has advanced an ingenious hypothesis according to which the monthly cycle is attributed to reciprocal action between the uterus, ovaries and mam-mæ. But, as we have seen, two of these supposed agents may be withdrawn with impunity.

An affirmative answer to this question is just as easy and may be just as absolute as those in the negative. There is not the slightest doubt that the functional process by which the monthly cycle is accomplished

is seated in the ganglionic nervous system. The expansion of the pelvis, the growth of the breasts, and the increase of adipose tissue which take place when the young girl arrives at the age of puberty, depend upon a modification in the nutrition of the parts, and that nutrition throughout the body, is presided over by the ganglionic nerves, no one of the present day will deny. In order to achieve such important variations from the previous course of nutrition, the nervous tissue itself must undergo structural development, which, as we have already said, like all other structural alterations, has a tendency to be permanent. In the course of this development, the elements of the Law of Periodicity are elaborated and the series of changes constituting the monthly cycle are instituted. The operation of the Law, being usually declared through the circulation (by means of hæmorrhages) which, like nutrition, is controlled by the ganglionic system.

[While this reprint has been going to press I have met with the report of a case of double ovariectomy by Verneuil and Terrier, in the *American Medical BiWeekly* for Jan. 19, 1878, which is of interest in connection with the attempt to explain the continuance of menstruation after the removal of both ovaries, by force of habit. The following is an extract therefrom.

“The operation took place on July 6, 1875. No uterine hæmorrhage took place till the following December. On December 25th menstruation appeared, was very profuse for four days, and lasted in all six days. Menses did not recur till February 20, but were then so abundant as to compel the patient to keep in bed, lasting for ten days.
* * * Until the summer of 1876, menstruation only occurred each alternate month; from that time it became regular with an interval of from four to five days over a month, lasting regularly from six to eight days, and accompanied by neuralgic pain in the left breast and arm.” *ANNALES DE GYNÆCOLOGY.*]

THE CYCLICAL THEORY OF MENSTRUATION.

From the American Journal of Obstetrics, October, 1878.



Some confusion has arisen with reference to the scope and signification of the term Menstruation, in consequence of certain writers having proposed to interpret it in accordance with their own theoretical ideas of the origin or purpose of the menstrual function. In order to avoid all embarrassment from this source, I shall use the word in its primitive and most restricted sense, as implying, simply, a sanguineous defluxion from the genital tract of the human female, the chief characteristics of which are that it is not symptomatic of disease and has a tendency to recur periodically, most frequently at monthly intervals. This defluxion may be regarded as the final event of a series, and an inquiry into its nature must, necessarily, involve a consideration of all associated phenomena. I will accept as demonstrated facts, that the discharged fluid consists, essentially, of unaltered blood, and that it proceeds from ruptured capillaries on the internal surface of the body of the womb.

The testimony of all observers, concurs as to the coincidence of a general congestion of the generative organs with the menstrual flow; and that these bear to

each other the relation of cause and effect, I can see no sufficient reason to doubt, notwithstanding the paramount importance which some recent observers attach to the structural changes which take place in the uterine mucosa. The congestion uniformly precedes the flow, when it attains its greatest intensity the flow ensues, and subsequently it subsides. An invariable antecedent and concomitant is not necessarily the cause of an effect; but when the antecedent is of a nature, according to our conception of the action of forces, to produce the sequence, it is presumable that the one has taken part in the causation of the other; and this presumption is converted into a certainty, when the withdrawal of the first prevents the occurrence or suspends the existence of the second. The engorgement which preludes and accompanies menstruation is of the kind specified, for nothing is more reasonable to suppose, than that blood vessels are liable to be ruptured by distention and its extinction by means of venesection prevents or arrests the flow. Hence I feel authorized in assuming that *the congestion of the uterus which obtains at the menstrual period is the principle factor in the production, if not the sole cause, of the hemorrhage.*

It can not be denied that the mucous membrane of the uterus undergoes notable alterations in connection with menstruation. These have been described as consisting of tumefaction, in consequence of enlargement and proliferation of its component cells (Hypertrophy and Hyperplasia), and afterwards in fatty degeneration and more or less exfoliation. A difference of opinion exists as to the extent to which the latter process is carried. Engelmann* maintains that the fatty degeneration is confined to the superficial layers

* American Journal of Obstetrics, May, 1875.

and that simply a portion of the epithelial investment is thrown off; whilst Williams* contends that the whole thickness of the membrane undergoes disintegration and desquamation. I do not propose, in this connection, to discuss the relative merits of these two opinions, but will simply say, that on account of the hystological objections advanced by Engelmann against the latter, together with certain physiological reasons, I am disposed to adopt his views, in preference to those of Williams. In either case, the effect would be to weaken, denude, or disorganize the walls of the capillaries, and in this way determine the escape of blood from the free surface of the uterine cavity.†

There is not the slightest doubt in my mind, however, that these structural changes are, themselves, dependent upon the congestion. Growth and Nutrition were at one time regarded as purely vegetative functions, over which the nervous and vascular supply exercised no modifying influence. Virchow, in particular, maintained this doctrine; the development which took place under the action of a local stimulus, he attributed, to what he designated, "*nutritive and formative* irritation of the tissues themselves;" but it is a little curious that the very experiment which he cited (section of the cervical sympathetic) as showing that active hyperæmia could not engender hypertrophy, has since afforded proof directly to the contrary. Recent authorities admit, not only that active, but that passive congestion,

* Obset. Jour. of Great Britain and Ireland, Feb. and March, 1875.

† Leopold could not detect any retrograde metamorphoses and denies their existence. (Am. Jour. Obstet's, April, 1878.) But positive evidence is more valuable than negative, and as I regard Engelmann as a competent observer, I must give my credence in favor of his statements. The truth of the matter, I believe to be that these changes are not absolutely necessary to enable the hemorrhage to take place, as is indicated in vicarious menstruation, where the unaltered capillaries of the skin and mucous membranes are ruptured; and in uterine menstruation they probably vary in degree in different individuals, and in the same individual at different times; possibly, in some cases, they may be absent, entirely.

also, may cause hypertrophy and hyperplasia, examples of which are seen in the various forms of varices from obstruction. In order to have this effect, the congestion must be slowly established and must continue for a good while, when suddenly induced, the tendency is, rather, to serous effusion. Billroth says on this subject, "Continued stagnation of blood or lymph, as well as their coagulation in the vessels, first induces hyperplasia of the walls of the vessels and the parts immediately around them, distention and tortuosity of the vessels, and thickening of the tissue; the skin of the leg is particularly exposed to this disease, when there is any continued opposition to the escape of venous blood from the extremity." Pathologists do not agree, exactly, as to the way in which these hyperplasias are produced; according to some, they depend upon proliferation of the original cells, and others attribute them to an infiltration of the tissues with white blood corpuscles, *wandering cells*, which escape from the vessels in consequence of intra-vascular pressure. Making the proper allowance for this difference in opinion, and the consequent difference in phraseology on the part of observers, we will find the descriptions of the changes which occur at the menstrual period in the lining membrane of the uterus, correspond very closely with those of hypertrophy and hyperplasia in other parts of the body from various causes, including obstructive venous congestion. In fact, the only essential peculiarity of the former is the low vital activity by which it is characterized, for, notwithstanding the multiplication in the cellular elements, there is no formation of new blood vessels (Engelmann), the membrane loses its tenacity, becoming sometimes almost diffuent, and finally undergoes fatty degeneration, the

most common cause of which is defective nutrition.

The explanation given by Engelmann of the discrepancy between the results of his own investigations and those of Williams, is in unison with this idea of a low organization of the menstrual neoplasm. He claims that his specimens were taken chiefly from the bodies of women who had died of acute diseases or from violence; but those of Williams were of a pathological character, the individuals having been, for the most part, subjects of exhausting diseases, such as typhoid fever, pneumonia, etc. From this it would appear that he believes a vitiated and depraved state of the nutritive functions in general, favors and intensifies the molecular changes referred to.

The Ovular Theory of Menstruation teaches that, when a Graafian vesicle approaches maturity, it creates an irritation which determines an afflux of blood to the pelvic viscera. If this were true, the congestion should be somewhat rapidly established, and should subside precipitately, for the rupture of the follicle would at once remove the source of irritation. On the contrary, we know that the menstrual perturbation advances slowly to its acme, and recedes in a like manner. Every physician who has used the speculum much, is aware that blood, or bloody mucus, may be detected issuing from the os uteri twenty-four, sometimes forty-eight, hours before and after the discharge is noticed externally. If the initial and concluding stages are thus protracted, it is reasonable to infer that the preliminary changes which induce the hemorrhage, are equally gradual in their progress, and that after its cessation, some time must elapse before the disturbing influences would completely subside.

Engelmann deduced a similar opinion from his

anatomical researches as the following quotations will show. "The facts gathered warrant the conclusion that the mucous membrane of the womb begins to increase in thickness and succulence as the time of menstruation approaches, that the tumefaction is most marked during the period itself, and gradually decreases after the catamenial discharge." "Anatomical experience, as I will show, does not bear out the assumption, which theoretically appears well founded, that the menstrual changes of the mucous membrane just described, come and go as rapidly as the menstrual period itself." "We rarely find a completely normal, inactive uterine mucosa, which seems to indicate that the actual period of rest for that membrane is much shorter than is generally assumed."

Ritchie says, "Menstruation gives rise to a congested state of the uterine vessels, manifested by a redness and increased vascularity of the vagina, and the production on the internal surface of the cavity of the uterus of a meshwork of deciduous, villous vessels, which may remain for two weeks."

It will hence be seen that ample time is allowed for the menstrual development to take place under the influence of congestion.

The most interesting and important of all the problems in this connection, is that which relates to the vascular mechanism by which the menstrual congestion is produced. Before we enter upon this inquiry, however, it will be advisable to obtain a correct conception of the general features and extent of the congestion.

During menstruation the uterus undergoes a considerable augmentation in bulk, which may be appreciated by a digital examination per vaginam, or by the use

of the sound. Its weight is, of course, correspondingly increased, and there is a slight tendency to prolapsus. It has also been noticed, in flexions of the organ, that it becomes straighter, and may even assume a perfectly normal shape. These modifications have been imputed exclusively to the engorgement of the uterine blood-vessels; but in view of the development which takes place in the mucous membrane, it becomes highly probable that the same influences would engender an analogous development in the parenchyma, and the enlargement may to a certain extent arise from this cause. It must nevertheless be admitted, that the force of the congestion is very great, as is evinced by the distention of the womb when the menses are retained within its cavity, by the occasional bursting of the Fallopian tubes, and by the rupture of veins. In accidents of the last kind, it is true, it is surmised that the coats of the vessels have been already weakened by long-continued dilatation, the veins in this locality being exceedingly prone to become varicose, owing to the absence of valves, and this tendency is increased by pregnancy; but instances have been reported of such events occurring in young girls who had never conceived, in which there was no ground to assume the pre-existence of a morbid state. One case in point is recorded by Tuckwell, where a fatal catamenial hemothorax ensued from the rupture of a vein of the left Fallopian tube, in a girl eighteen years of age. In autopsies of women who have died while menstruating, the uterine and ovarian plexuses have frequently been found much engorged, but that this should not uniformly be the case is very easily accounted for; the cause of the congestion being a vital action, would cease with death, and the blood would seek an equi-

librium with that in the rest of the venous system,

The ovaries participate in an equal degree with the uterus in the menstrual congestion; in some cases their firm tissue has been rent asunder and apoplectic clots of considerable size formed within the substance of the organs; and the Fallopian tubes, the vagina, and the external genitalia are more or less affected.

It is really remarkable how little attention this question has received at the hands of gynecologists. Most of them make no allusion to the nature of the menstrual congestion, and those who do are wonderfully brief and unsatisfactory. Meigs, for instance, speaks of it as "A positive affluxion of sanguineous humors * * * to the whole system of the reproductive organs;" Barnes says, "The active physiological process going on in the ovaries naturally determines the blood-current in especial force to the pelvic organs;" and Schroeder simply denominates it an "arterial congestion." As indicated by these expressions, the prevailing sentiment appears to be, that it is of the character of what is called an ACTIVE CONGESTION, one in the genesis of which the arteries are the efficient agents. It has been suggested that the arteries might possess the power, by means of peristaltic action, of exerting a propulsive force upon their contents, and in this way of driving the blood into the structures to which they are distributed; but this idea has been abandoned, and the only form of active congestion now recognized by physiologists is that which accrues from a relaxation of the muscular coats of these vessels, in consequence of which they dilate and permit the tissues to be inundated, so to speak, with blood. I know of no proofs that have ever been advanced to show that this is the form of

congestion which takes place in the generative organs during menstruation. It seems to be a mere assumption based upon a supposed analogy with what is witnessed in glandular structures in states of physiological activity, and in parts subjected to local irritation, while very strong evidence may be adduced to the contrary.

The internal organs of generation are supplied with blood by four arteries, the uterine and the two ovarian, each of which is accompanied by at least one vein, and usually the uterine veins are double. Physiologists tell us that the veins throughout the body are between three and four times more capacious than their associate arteries, and that this disproportion persists down to the capillaries. An inspection of a carefully injected dissection of the pelvic viscera will convince any one that the vessels here do not afford an exception to this rule. Immediately upon emerging from the uterus, the veins anastomose freely with each other and with the extensive venous plexuses in the vicinity, so that the channels for the egress of blood and its onward flow to the vena cava are exceedingly ample.

Supposing a progressive dilation of the arteries to set in; it is clear that they could not conduct enough blood into the parts to tax the capacity of the veins in carrying it off until they had attained three times their original calibre. After this point was passed, and the apertures of influx become greater than those of efflux, an accumulation of blood would take place in the capillaries and erectile spaces, and a gradually increasing pressure would be exerted on their internal surfaces; but it must be seen by any one acquainted with the most elementary principles of

physics that this pressure could never be rendered equal to that with which the blood is propelled in the arteries, as long as there was any leakage. To accomplish this, the venous conduits must be hermetically closed, and the cells filled by the arteries in the same manner that the cistern of a hydrostatic press is filled by its injecting pipe. It is unfortunate that we have no means of gauging the pressure that is sustained by the tissues of the generative organs during menstruation; estimating it by its effects, I believe it to be, in some cases, little short of the full force of the arterial circulation. For a force even approximating this to be brought to bear, without closure of the veins, an enormous enlargement of the arteries would be requisite—one, at all events, sufficient to be detected by the sense of touch. Yet I have made many examinations of the uterine arteries, through the walls of the vagina, without being able to perceive any increase in their size or impulse at the menstrual periods. Fluctuations can be discerned, but they bear no fixed relations to menstruation, and depend, in all probability, upon some reciprocal action between the uterine and ovarian arteries.

Admit, for the sake of argument, that the necessary arterial action might occur without being detected, or that the work of flooding the parts with blood devolves exclusively upon the ovarian arteries which are out of reach, we would thus account for the parenchymatous swelling of the uterus and ovaries; but can we imagine it possible for the blood to pass through these structures with sufficient force and in sufficient quantity, subsequently to distend the veins, even to rupture them? This query I should most assuredly answer in the negative; for it must be remembered

that the resistance offered by the capillaries to the passage of the blood takes off from three-fifths to two-thirds of its force, and that the walls of the veins are elastic, and, although thinner than those of the arteries in their normal state, are more capable of resisting pressure.

I at one time hoped that this point might be definitely settled by thermometric observations upon the generative organs, but have found the subject more intricate than I anticipated, and have not been able to arrive at positive results; yet the burden of the evidence, if I do not misinterpret it, is against the theory of arterial congestion.

It is now an established fact that the temperature of a part depends largely upon its blood supply, and if there is an increased afflux of blood to any organ or tissue in a physiological state, an elevation of temperature invariably follows.* In experiments in which paralysis of the vaso-constrictor nerves has been artificially induced, an astonishing increase of heat has been observed. For example, in some instances, where the sympathetic nerve has been divided in the neck, causing a dilatation of the vessels on that side of the head, the temperature has risen as much as 18° Fahr.

Very little seems to be known as to the variations of the temperature of the generative organs in connection with menstruation. Schroeder remarks that, "In opposition to the older statements, Rabuteau declares that the temperature, as measured in the vagi-

* "It is certain that whatever determines an increased supply of blood to any part, raises the temperature; and, whenever the quantity of blood in any organ or part is considerably diminished, its temperature is reduced."—[Flint's Text-Book of Phys., page 514.] Of course Dr. Flint here speaks of parts in an otherwise healthy condition.

na, shows an average depression of about 1° Fahr., and that the frequency of the pulse is also less. The excretion of urea is also diminished. Hennig was able to confirm the fall of the pulse, but not of the temperature." In my own investigations I have encountered very great difficulties, the chief of which has arisen from my inability to procure perfectly healthy individuals as subjects, by whom to establish a physiological standard. I have made over six hundred observations distributed among eighteen women, in every one of whom some trouble of the generative organs was at least suspected. In some the actual disease was slight, and in two who had applied for relief from sterility, nothing abnormal could be detected. I have found that there is *almost* always an appreciable alteration of the temperature of the uterus and vagina as compared with that of the body, as indicated in the axilla, at the menstrual periods. In the majority there was a relative elevation of the temperature of these organs, in the early stages of menstruation, but in no instance did the maximum during menstruation exceed that of the intermenstrual period more than $\frac{1}{2}^{\circ}$ Fahr. In some the relative temperature would fall at one period and rise at another from causes of which I could take no cognizance; and in others *it would be uniformly depressed at the menstrual periods*, the depression usually manifesting itself several days beforehand. The following case affords an example of the last kind:

The subject of the observations was a virgin, twenty years of age, and of delicate aspect. Her local troubles were anteflexion of the womb and tenderness, with some enlargement, of the right ovary.

DATE.	Temperature of Vagina	Temperature of Uterus	Temperature in Axillary space	Excess of Vaginal Temperature over Uterine	Excess of Vaginal Temperature over Axillary	Excess of Uterine Temperature over Axillary	Pulse	Day of Menstruation	The pulsations of the uterine arteries could not be felt through the vaginal walls at any time.
Oct. 3...	99 $\frac{1}{4}$ ⁰	.....	98 $\frac{1}{4}$ ⁰	.....	10	.....	...
Oct. 9...	99 $\frac{1}{2}$	99 $\frac{1}{4}$ ⁰	98 $\frac{1}{2}$	1 $\frac{1}{4}$ ⁰	1	3 $\frac{3}{4}$ ⁰	80		
Oct. 12...	99 $\frac{3}{4}$	99 $\frac{1}{4}$	98 $\frac{3}{4}$	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	84		
Oct. 13...	99 $\frac{1}{2}$	99 $\frac{1}{4}$	98 $\frac{1}{2}$	1 $\frac{1}{4}$	1	3 $\frac{3}{4}$	82		
Oct. 14...	99 $\frac{1}{4}$	99 $\frac{1}{4}$	98 $\frac{1}{2}$	1 $\frac{1}{4}$	1	3 $\frac{3}{4}$	76		
Oct. 15...	99 $\frac{1}{2}$	99 $\frac{1}{4}$	98 $\frac{1}{2}$	1 $\frac{1}{4}$	1	3 $\frac{3}{4}$...		
Oct. 16...	99 $\frac{1}{4}$	98 $\frac{3}{4}$	98 $\frac{1}{2}$	1 $\frac{1}{2}$	3 $\frac{3}{4}$	1 $\frac{1}{4}$	82		
Oct. 17...	99 $\frac{1}{4}$	99	98 $\frac{3}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{1}{4}$	78	1st day.	{ Menstruation free and painful.
Oct. 18...	99 $\frac{1}{2}$	99 $\frac{1}{4}$	98 $\frac{3}{4}$	1 $\frac{1}{4}$	3 $\frac{3}{4}$	1 $\frac{1}{2}$	70	2d day.	
Oct. 20...	99 $\frac{1}{2}$	99 $\frac{1}{4}$	98 $\frac{3}{4}$	1 $\frac{1}{4}$	3 $\frac{3}{4}$	1 $\frac{1}{2}$	73	Last d.	
Oct. 23...	99 $\frac{1}{2}$	99	98 $\frac{1}{2}$	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	88		
Oct. 30...	99 $\frac{1}{2}$	98 $\frac{3}{4}$	98 $\frac{1}{4}$	3 $\frac{3}{4}$	11 $\frac{1}{4}$	1 $\frac{1}{2}$	86		
Nov. 6...	99 $\frac{1}{4}$	99 $\frac{1}{4}$	98 $\frac{1}{2}$	0	3 $\frac{3}{4}$	3 $\frac{3}{4}$	81		
Nov. 12...	99 $\frac{1}{4}$	99 $\frac{1}{4}$	98 $\frac{1}{2}$	0	3 $\frac{3}{4}$	3 $\frac{3}{4}$	84		
Nov. 14...	99 $\frac{1}{2}$	99 $\frac{1}{2}$	99	0	1 $\frac{1}{2}$	1 $\frac{1}{2}$	86		
Nov. 16...	99 $\frac{1}{2}$	99 $\frac{1}{2}$	99 $\frac{1}{4}$	0	1 $\frac{1}{4}$	1 $\frac{1}{4}$	84	1st day.	{ Suffering from severe cold. Menstruation free and slightly painful.
Nov. 27...	99 $\frac{1}{2}$	99 $\frac{1}{2}$	99	0	1 $\frac{1}{2}$	1 $\frac{1}{2}$	80		
Dec. 7...	99 $\frac{1}{2}$	.....	98 $\frac{1}{2}$	.....	1	.....	84		
Dec. 11...	99 $\frac{1}{2}$	99 $\frac{1}{4}$	98 $\frac{3}{4}$	.....	3 $\frac{3}{4}$	.....	92		
Dec. 20...	99 $\frac{1}{2}$	.....	99 $\frac{1}{4}$	.....	1 $\frac{1}{4}$	.....	80	2d day.	{ Menstruation free. No pain.

In order to produce the mechanical effects heretofore alluded to, the arterial congestion must be quite intense, and, I should think, would necessarily lead to a greater elevation of temperature than was witnessed in any of my cases; and while I can readily conceive that a rise in temperature might accompany a venous congestion of the parts, I can not see how a fall in temperature could be compatible with an active hyperemia.

The only form of congestion to which all the phenomena of menstruation can be satisfactorily ascribed, is one due to an impediment in the course of the venous circulation. From this we would expect a low grade of hypertrophic and hyperplastic development; it would account for the distention of the veins, as well as of the parenchyma of the generative organs; for the force with which the blood is effused in

the uterine cavity in cases of cervical occlusion; for ruptures of the tubes and ovaries, and would not necessitate an enlargement of the arteries, nor lead, uniformly, to an elevation of the temperature.

The question next obtrudes itself upon us as to the nature of this impediment. Can we assign any reasonable cause for the venous obstruction?

A mechanical venous congestion is thought by some to exist in the process of erection of both the male and female organs, but is denied by others, chiefly in consequence of the difficulty anatomists have had in pointing out the manner in which it could be produced, and because erection does not follow the ligation of the principal veins of the penis. Muller long ago demonstrated that it required the full force of the arterial blood pressure to accomplish perfect erection, and, as we have already explained, this can not be brought into action without venous obstruction. Accordingly, in order to give the proper rigidity to the corpora cavernosa by artificial injection, he found it indispensable to prevent the return of blood through the veins by pressure *within the pelvis*. Thus the necessity for the existence of some means of arresting the venous current is proven mathematically and experimentally.

The mechanism by which this arrest is effected has, I think, been sufficiently indicated by modern anatomists. Savage states that, as the pudic vessels pass backward between the aponeuroses of the perineal septum, "the veins, unlike the arteries, are subject to compression by some of the muscular fibres of the septum which separate the two vessels by passing between them." Frey, in speaking of erection of the penis, says, "no doubt hindrance to the exit of the

blood from the organ increases the erection," which hindrance he believes to depend on the action of "smooth muscles." The uterus and ovaries are as eminently erectile in structure as the external organs, and since the rationale of erection must be the same in both cases, it is a valid inference that a similar collocation of muscular fibres must exist in connection with the uterine and ovarian veins or their branches. If, through the intervention of such an agency, the veins could be hermetically closed, complete erection would follow; but this is impossible, in consequence of the free venous anastomoses in these parts, and a supplementary action on the part of the arteries becomes necessary, in order to give perfection and promptness to the process. For the execution of this function the arteries are peculiarly adapted in structure. Every investigator who has had occasion to refer to the subject at all, has noted the unusual thickness of the walls of the blood-vessels of the organs of generation, especially of the internal ones. This is owing to an excessive development of their muscular tunics. According to Frey, the arteries of the ovaries possess wonderfully thick muscular coats; and Chrobak says with reference to the vessels of the cervical portion of the uterus (which is believed by some to be endowed with special erectile properties), "The thickness of their walls is so disproportionate that the calibre of each vessel is only about a third of its gross diameter." Through this endowment, they are capable of undergoing either contraction or dilatation in an extreme degree. In the act of erection, as thus explained, we have a precedent for asserting the participation of an obstructive congestion in determining the functions of the generative apparatus.

The influences which preside over the menstrual congestion are generally believed to be circumscribed in character and limited to that portion of the organism in immediate relation with the generative organs. Savage mentions cases as having been recorded of double uterus, in which menstruation took place from the two horns at different epochs. If this were true, it would certainly tend to sustain the above idea; but I have not seen the original reports, and do not know by whom or with what accuracy the observations were made, and, consequently, do not attach any importance to them; especially as Klob states to the contrary on the authority of Kussmaul, that "in all these malformations of the uterus, menstruation occurs in the same manner as in the normal organ, and the menstrual flow proceeds from both, or only one uterine half."

During menstruation, disturbed innervation and disordered vascular action are witnessed throughout the entire economy. In vicarious menstruation we have the specific phenomena of menstruation, periodic physiological hemorrhage, manifesting itself in different parts of the body, and this, notwithstanding the normal discharge from the uterus may continue, showing that there is not simply a diversion of the menstrual force from its usual channels, but that distant parts are affected simultaneously in the same way.

Scanzoni is undoubtedly correct in attributing vicarious menstruation, not to a concentration of nervous energy upon the affected part, but, as a general rule, to an abnormality of the implicated tissues. Thus, some years ago, a young woman was under the joint care of Dr. E. R. Palmer and myself; upon one cheek there was a large *nevus maternus*, and the same con-

dition of the blood-vessels existed in the buccal mucous membrane, extending as far as could be seen down the throat. At her menstrual periods she frequently suffered from hemoptysis, the blood coming from the pharynx and upper part of the esophagus. Recently a still more striking case has occurred in my own practice. A girl, now sixteen years of age, has been my patient since infancy. When quite young, she complained of symptoms which led to an examination of the throat, and it was discovered that one tonsil and the corresponding half of the pharynx presented the appearance of a capillary nevus. Inflammation from cold would cause these structures to become very much swollen, and sometimes to bleed. Bearing in mind the previous case, I predicted that she would menstruate vicariously from this locality when she arrived at puberty. The first menstrual period occurred in August last (1877), and, as is frequently the case on such occasions, the menses were intense and the hemorrhage very free. On the second day she began to spit blood, and in the course of a few hours the hemorrhage from the throat became alarming. Under the exhaustion thus produced, the discharge from the uterus ceased, the vicarious menstruation continuing for three days. Upon each subsequent epoch the flow has been moderate, and accompanied by an expectoration of bloody mucous. Cases of a similar nature have been met with, in which the diseased surfaces were situated on various parts of the mucous membranes and the skin.

What explanation can be given of such cases? Why do the walls of capillaries, which happen to be abnormally attenuated, rupture and pour forth their contents coincidently with the menstrual epochs? It

can only be in consequence of increased pressure from within, and this increased blood-pressure must depend upon a contraction of the muscular elements of the arteries and veins.

Other proofs may be advanced, not only confirmatory of the existence of augmented vascular tension, but showing that it antedates the menstrual flow. Women who are affected with varicose veins experience a fullness in them several days before menstruation. One of my patients has a knot of varicose veins in the bend of the knee; about three days before menstruation these become so swollen and tender as to interfere with locomotion; the pain is somewhat mitigated when the flow is established, and ceases entirely upon its subsidence. The thyroid gland, the spleen, and hemorrhoidal tumors are known to enlarge before and during menstruation; the capillaries of the mucous membranes have been noticed to become injected at this time, and the bluish hue and puffiness of the skin below the eyes, so commonly observed, can only be attributed to an engorgement of the smaller vessels in these loose tissues.*

The tendency of this increased contractility of the vasomotor muscular fibres, at large, would be to expel the blood to a certain extent from the arteries and larger veins, and to cause it to accumulate in those vessels which are unprovided with muscular coats, especially the capillaries and smaller veins; while the venous system, as a whole, possessing less tonicity than the arterial, would be the receptacle of a relatively larger quantity of blood than usual. As the vena cava communicates with the internal organs of

* See Tilt on Uterine and Ovarian Inflammation, Third Edition, page 159, *et seq.* Jones and Sieveking's Pathological Anatomy, First Am. Ed., page 539. Whitehead on the Causes and Treatment of Abortion and Sterility, Second Am. Ed., page 36.

vena cava communicates with the internal organs of generation, by means of the ovarian veins and the uterine branches of the internal iliacs, and since these, as well as the veins in the substance of the organs, are devoid of valves, the full force of the retrograde venous pressure would be exerted upon the tissues of the uterus and ovaries, creating there a state, to all intents and purposes, analogous to obstructive venous congestion. The structures on the inner aspect of the uterus not only participate in the general condition, but their blood-vessels having to traverse the central or medullary portion, where they are subjected to pressure in consequence of the turgescence of the erectile spaces, the circulation is still further affected; in this way the mucous membrane of the uterus becomes the seat of a gradually increasing congestion, in which the quantity of blood in the part is augmented, but the amount passing through it in a given time is progressively diminished. Such a congestion would occasion the hypertrophy and hyperplasia of the connective tissue already mentioned; and when the blood supply becomes insufficient for the proper nutrition of the tissues, fatty degeneration and a breaking down of the superficial layers would ensue. The relative time, with reference to the progress of these changes, at which the hemorrhage occurs, I believe varies in different individuals. The strength of the walls of the capillaries can not be the same in all cases; in some they probably yield at an early period, while in others they are capable of resisting until the disintegrating process sets in.

It might appear, in view of the fluctuations in the actual amount of the contents of the blood-vessels, arising from the irregularity in the absorption of

ingesta, and the variations in the force and frequency of the heart's action, that the blood pressure could not be maintained with sufficient uniformity to accomplish so definite a result. Some very interesting experiments, by Worm-Muller and L. Lesser, are referred to in an article by Lesser, in the Transactions of the New Sydenham Society, vol. lxxi., which throw light upon this point. By these it is shown that, if the quantity of blood in a healthy animal be increased by transfusion, there is at first a slight elevation of the blood pressure which soon subsides; if the operation be renewed, the pressure can not be made to rise again above the normal, though the original amount of blood in the body of the animal be doubled or tripled. If an animal which has previously been bled be transfused, the blood pressure may be restored to the normal, but can not be made to go beyond. A slight bleeding has no perceptible effect upon the blood pressure, but free venesection causes it to fall regularly until it reaches zero. The researches demonstrate that, when the blood-vessels are not suddenly and abnormally depleted, the blood pressure is regulated by the vaso-motor muscles.

Although I regard this general action on the part of the circulatory system as in itself a sufficient cause for all of the ordinary phenomena of menstruation, it does not seem to me to satisfactorily explain certain cases of vicarious menstruation, nor fully to account for some of the mechanical effects witnessed in connection with the generative organs, such as the rupturing of veins, the rending of the ovarian stroma, etc.

Take, for instance, the following case of vicarious menstruation which occurred within my own experi-

ence: An unmarried woman, twenty-six years of age, applied to me for treatment for supposed womb disease. She was of spare habit and anemic, having always suffered from derangement of the digestive organs, and since puberty had experienced many distressing nervous symptoms. Menstruation was scanty and painful, and at each period, for some months previously, on the first or second day, red splotches of variable size and shape, would make their appearance on the upper parts of the chest and arms. These were undoubtedly ecchymoses from ruptured cutaneous capillaries. After a few days they would fade away, leaving the skin, in so far as an ocular inspection could determine, in a perfectly natural state. Could these vessels have been ruptured in consequence of an increase in the general blood pressure? I think not. There are capillaries, more delicate than those of the skin, which would have yielded in preference. In the experiments of Worm-Muller, when the vascular system was filled to repletion, the first extravasations occurred on the surface of the serous membranes. It is impossible for this extreme distention of the capillaries to arise from any action of the blood-vessels, for the arteries, being more muscular than the veins, would contract with the greater force, and capillary anemia, rather than plethora, would be the result. The efficient cause must be extraneous to the blood-vessels. The corium, the deeper layer of the true skin, is rich in involuntary muscular fibres, which surround the blood-vessels that pass to and from the more superficial or papillary portion; a contraction of these would have the effect of damming up the blood in the capillaries, for the walls of the venous radicles are thinner and more

yielding than those of the arterioles. That some subsidiary influence is exerted by this class of muscular fibres is sustained by the fact that vicarious menstruation is common from the cutaneous and mucous surfaces, the mucous membranes being also largely provided with muscular tissue (*muscularis mucosa*), while it never takes place from serous membranes in which this histological element is almost, if not entirely, wanting.

In looking to the generative apparatus for some means through which the blood stasis may be intensified in uterine menstruation, we find a system of muscular fibres apparently especially adapted to this purpose. Of these Virchow gives the following description: "In the *alæ vespertilionum* we find, moreover, very beautifully displayed a condition which is of frequent occurrence in the appendages of the generative organs, * * * the vessels, namely, are accompanied by flat bundles of smooth muscle in considerable quantity, which do not belong to them, but only follow the course of the vessels, and in part receive the vessels into them." Furthermore, the uterus itself is encompassed by a layer of subserous muscular tissue (*sero-muscular platysma*), resulting from a spreading out of these bundles upon its surface, which is in close relation to the blood-vessels as they emerge from its external cortex. I think it exceedingly probable that these muscular fibres participate in the determination of the local phenomenon of menstruation. They "do not belong to" the blood-vessels, yet their relation to them is so direct and intimate, that there can be no doubt of their being associated with them functionally, and this, together with their close proximity, renders it likely that they

receive their nervous supply from the same source. It is true that they surround the arteries as well as the veins, and their contraction would exercise an equal pressure upon both sets of vessels, but the walls of the veins would collapse more readily than those of the arteries, and their circulation would be the first to be impeded.

Whether or not these are the same muscles that are concerned in the erection of the internal organs of generation I will not attempt to decide; but even if they are, I see no reason why they should not take part in both processes. The essential difference between the circulatory disturbance of menstruation and that of erection is, that the former is slowly established, and during its continuance the tonicity of the walls of the arteries is increased; while the latter is sudden in its occurrence, and an emotional or cerebral element entering into the nervous influence, by which it is produced, there is relaxation and enlargement of the arteries. Hence it is that erection at the time of menstruation is attended with danger to the integrity of the tissue; of ten cases of catamenial hemocele reported by Voisin, seven began during sexual intercourse.

The conclusions, then, to which I am led as to the nature and cause of the menstrual function are;

1st. *That menstruation is the result of a general condition of the vascular system, the local manifestations occurring, as a rule, in the generative organs, from the fact that they are especially adapted, anatomically and histologically, for their display.*

2d. *That the general disturbance of the vascular system is of a nature to elevate the blood pressure throughout the entire organism, and arises from a*

contraction of the muscular coats of the arteries and veins.

3d. *That, in all probability, when the tension of the vascular system reaches its greatest degree, activity is imparted to certain muscular fibres, which, from their collocation and only possible function, must be regarded as accessory to the vaso-motor muscles, and through their co-operation the local phenomena are intensified.*

If this view of the proximate cause of menstruation be accepted, the periodicity of the function admits of a very simple explanation, as it may be attributed to the intermittent action of involuntary muscular fibres. As is well known, the energy of this kind of muscular tissue is exerted paroxysmally, periods of activity alternating with states of rest. Each muscle or set of muscles, however, has a rhythm of its own; the heart, for instance, contracts and relaxes with great regularity seventy or eighty times a minute, and the uterus only once in from two to thirty minutes or more; while the vaso-motor muscles seem to have allotted to them a longer time for repose and correspondingly slower mode of action.*

I have elsewhere† taken the ground that the physical changes of puberty are nothing more than hypertrophies of certain tissues called into being through an altered state of the nerves, which preside over their nutrition, and that the nervous system itself must undergo a certain degree of structural development in order to engender them. These changes are of the same nature in the two sexes, but affect

*Sleep and hibernation are periodic phenomena; to some extent at least, of an intrinsic nature. In the former, the arterioles of the brain are contracted, while in the latter there is general contraction of the blood-vessels throughout the organism, and there is every reason to believe that the two states are due, respectively, to these vascular conditions; thus affording us other examples of slow rhythmical action on the part of the vaso motor muscles.

†Richmond and Louisville Medical Journal, November, 1875.

different parts. The most notable in the male are the development of the larynx and the growth of hair upon the face; and in the female the expansion of the pelvis, the enlargement of the breasts, and the increased deposit of fat; but there are others of a less obvious character, which pertain to almost every organ and tissue in the body, and among these I believe there is in the female a hypertrophy of the muscular fibres in the walls of the blood-vessels. It is this hypertrophy that enables, it may be impels, them to assume their periodic function, just as we see in the pregnant uterus the muscular fibres more prone to spasmodic contraction in proportion to their development. *

Many physiologists of the present day hold to the doctrine first enunciated by Haller, that muscular fibres possess an intrinsic irritability, by virtue of which automatic movements may be accomplished. The alternate relaxations and contractions of the heart and uterus and the peristaltic actions of various viscera are regarded "as expressions of this peculiar vital endowment of their muscular tissue." Others, to the contrary, maintain that all muscular movements are instigated by nervous influence. My own convictions are with the latter. I see no sufficient reason for believing that muscular fibres have an inherent power of altering their condition, and am forced to adopt the opinion that all of their functional movements at least arise from excitations emanating from nervous centres. There can be no doubt but their equilibrium may be disturbed by chemical or mechanical irritants directly applied, but it is impossible to

*I do not wish to be understood as asserting that the nerves necessarily exert a *trophic* action. All of these hypertrophies may arise from modifications of the circulation, and that the vaso-motor nerves regulate the amount of blood sent to a part can not be denied.

prove that such impressions are ever concerned in determining their functional action, except in a reflex manner through the intervention of the nervous system, in which process the motor impulse in reality proceeds from a nervous centre.

The rhythmic movements of various organs evidently depend upon sources of power resident within their structures. The heart of the alligator will pulsate for hours after excision. The intestinal canal presents its vermicular motions when removed from the body, and the separated oviduct of the turtle has been seen to contract so as to expel its ova. It is even claimed by some that the action of the heart continues in vacuo. Phenomena of this kind, where the parts were disconnected from all recognized nervous centres, led the older physiologists to conceive the idea of a motility belonging to the muscles themselves; but we now know that, interspersed among the organic muscular fibres, there are innumerable ganglia, ganglion cells, and nucleated fibres, which are capable of generating nervous force, and it can not be shown that contractions can occur independently of them. Friedlander states that he has demonstrated the constant existence of ganglion cells in still pulsating portions of the heart of the frog, in which there were not in some instances more than two or three muscular fibres.

It is to nervous centres of this class, located in the walls of the blood-vessels, which, it is presumable, partake of the puberal development that affects the muscular tissue with which they are intimately associated, that I would ascribe the dynamic cause of the periodic activity of the vaso-motor muscles. As elaborators of nervous force, they are independent agents,

but in the exercise of this force they are doubtless subject to disturbing influences originating in other sympathetic ganglia and in the cerebro-spinal centres, on the same principle, but not to the same extent, as is known to be the case with the intermuscular ganglia of the heart. What the process is by which their action is rendered intermittent, I will not discuss. It may consist of a recurring series of physiological acts, or it may be simply an alternation of exhaustion and recuperation of nervous energy. In either case there is a repetition of similar events in regular order of succession from first to last, and then returning to the first. Hence, I have entitled this exposition of the cause of woman's peculiar attribute, *THE CYCLICAL THEORY OF MENSTRUATION.*

The effect of conception upon the vascular changes of the menstrual cycle is worthy of note. The mere presence of the fecundated ovum makes an impression upon the organism of the female, and creates a powerful reaction, the first effect of which is, that the parts in the immediate vicinity of the point where it comes in contact with the maternal tissues, become the seat of an active hyperemia, which gradually extends, until, in normal pregnancy, it involves the whole uterus. A rapid and progressive development of all the tissues of the womb now sets in, and the arteries continuing to enlarge, the supply of nutritive material increases with the demand, and it is not until months have elapsed, and gestation is drawing to a close, that any retrograde metamorphoses are witnessed in the hypertrophied mucous membrane that lines the cavity of the body of the organ (Engelmann). In all varieties of extra-uterine fetation, a similar influence is exerted upon the structures where

the implantation occurs ; but, what is more curious, in such cases, when the generative organs are not implicated, the uterus undergoes the same development as in ordinary pregnancy.* This shows that the inhibitory reaction of the vitalized ovum upon the blood-vessels is not of a purely local character, but extends to the system at large, the vascular apparatus of the uterus responding more readily to the impression than that of other parts, in consequence of its peculiar muscular endowment. During gestation the periodic contraction of the vaso-motor muscles is in this way inhibited, and menstruation suspended. But I do not believe that the physiological steps of the nervous cycle are arrested, since it sometimes appears that the antagonistic influence is insufficient, and actual menstruation persists for a time after conception, and, as a general rule, evidence of their continuance may be detected under favorable circumstances. Most women experience some indications of the return of the menstrual epochs in pregnancy, and it is a well-established fact that abortions are most apt to happen at such times.

[Ever since the promulgation of the discoveries of Marshall Hall, the distal phenomena of pregnancy, as well as of menstruation, have been explained upon the principle of REFLEX ACTION, according to which certain parts hold special relations to other parts through the medium of the nervous system, in consequence whereof, a stimulus being applied to the one, a definite result is manifested in the other. Take, for example, the mammary changes of pregnancy ; here, it is thought, an impression is made upon the nerves of the uterus, which, passing to the nervous

*Parry on Extra-Uterine Pregnancy, page 73.

centers, is reflected thence to the breasts. But this I believe to be erroneous, and am constrained to attribute the constitutional symptoms of both pregnancy and menstruation to the vascular states by which they are respectively characterized. Let the ovum be misplaced, as in abdominal pregnancy, so that an entirely different set of peripheral nerves are involved, still the mammary development takes place; or, on the other hand, let the mammæ be situated in an unusual locality, as upon the *back, the abdomen or even upon the thigh*, and the same result ensues. (See *Am. Jour.*, Oct. 1878, page 719. Also *Davis' Obstetric Medicine*, 2d London Edition, page 502). These facts indicate that the uterus and the normal mammary region are not united by a fixed nervous chain, but that during gestation the whole organism is affected in the same way, and that these glands simply respond, in a marked degree, by virtue of some peculiarity inherent in their tissues. This influence must, of course, be conveyed through the nerves, and it is possible that the nervous action may be of a reflex character, through the intervention of a general vaso-motor center, but not necessarily so; inhibition of the blood-vessels of a part may be induced, extending backward from the points of irritation, after the nervous trunks have been severed, the impulsion traveling along the nerve-fibres from one minute intermuscular ganglion to another. (See *Foster's Text Book of Physiology*, 2d Edition, page 167). It is probably in this manner that the inhibitory influence of the ovum is propagated from the point of its affixation to the system at large.

The excitement observed in the mammary glands in cases of tumors and other diseases of the uterus,

shows that the influence exerted by the vitalized ovum upon the economy is not of a specific or peculiar nature, but is similar to that derived from other inhibitory stimulants, differing from them only in degree. While the reciprocal power exercised over the uterus by the mammary glands, as evinced by the induction of after-pains upon the application of the child to the breast, &c., proves that these glands, like the uterus, are highly endowed with the attributes necessary for receiving and imparting to the rest of the system this class of impressions, as well as for displaying their effects.


Thus it may be seen, I believe, a true, old-fashioned *sympathy* to exist between these organs on account of structural analogy. *Reprint, May, 1880.*]

The surgical, physiological and therapeutic bearings of this theory are numerous and important, but in view of the length to which this article has already extended, their consideration must be postponed to a future occasion. There is just one practical point to which I would at present call the attention of the profession. This has reference to the timing of surgical operations upon the female. In my opinion, no operation should be performed upon a woman during the increment of the cycle; that is, for six or seven days anterior to a menstrual epoch, and this rule should be rigidly observed whenever the individual is the subject of any derangement of the menstrual function. Some years ago I came very near losing a patient from whom I had removed a small tumor, situated in the vesico-veginal septum, six days before menstruation, the hemorrhage coming on twenty-four hours after the operation. Churchill mentions the case of a young lady who suffered from vicarious

menstruation. Upon one occasion, having been already reduced by bleeding from the mouth and gums, she was cupped for pain in the side, when it was found impossible to arrest the hemorrhage from the scarifications, and in less than six hours she died. I have met with several cases in which serious losses of blood followed the extraction of teeth at or about the menstrual period.

THE MENSTRUAL CYCLE.

*Published in the Transactions of the American Gynecological Society,
Volume II., for the year 1877.*



In the December number of "The Richmond and Louisville Medical Journal" for 1875, I published an article entitled "Menstruation and the Law of Monthly Periodicity," in which I endeavored to establish the following points: First—That the ovular theory of menstruation is untenable. Second—That menstruation is presided over by a law of monthly periodicity, which is the resultant and exponent of recurring cycles of physiological acts. Third—That the operation of this law is only manifested in the economy of the female, and in connection with the function of reproduction. Fourth—That the process by which the monthly cycles are accomplished is seated in the

ganglionic nervous system. On the present occasion, I propose to continue the inquiry there instituted, as to the nature of this law; and although I shall not attempt to determine the minute changes in the nervous tissues which produce the cycle and evolve the law, yet, as has been done with reference to malaria, without knowing or being able to demonstrate the thing itself, we may ascertain some of its characteristics, and in so doing render its existence more evident.

In the above mentioned publication, I accepted the opinion generally entertained as to the periodicity of menstruation, namely, that it takes place, as a rule, once in every twenty-eight days. As an elementary step in the further prosecution of our researches, it will be necessary to settle this point with precision. Is the period of time in which the monthly cycle normally revolves fixed and definite? If so, what is its exact duration? If not, is it variable; and to what extent, and according to what rules, if any, do these variations occur? In seeking an answer to these questions, I have not derived any satisfaction from the writings of physiologists and obstetricians; many of them dismiss the subject with a single sentence. Flint, for instance, in his elaborate work on "The Physiology of Man," simply says: "In the majority of cases, the flow recurs on the twenty-seventh or twenty-eighth day; but sometimes the interval is thirty days." All the information to be derived from Carpenter is to this effect: "The interval which usually elapses between the successive appearances of the discharge is about four weeks." Even where observations are referred to as the basis of conclusions, they have not been made with sufficient accu-

racy and detail to answer my present purpose.* I have, therefore, been compelled to institute the necessary investigations myself. For this purpose, I distributed among my patients, and through them to others, several hundred blanks, properly printed and ruled for recording the dates of the appearance and cessation of each menstrual flow, together with remarks as to its character, the general symptoms accompanying it, etc. Over sixty of these have been returned to me, more or less filled out; but some of them I have felt constrained to reject in consequence of apparent inaccuracies or illegibility, and others on account of confusion arising from hemorrhages caused by treatment for uterine disease. The whole number that can be implicitly relied upon as correct has in this way been reduced to forty-one. For the gratification of those who may wish to peruse these reports with a view to drawing their own conclusions, or testing the correctness of mine, I will give them condensed, from the original papers.†

In order to determine the length of the menstrual cycles in any given case, it is customary to count from the beginning of one flow to the beginning of the next. When we reflect, however, that hemorrhage from the uterus is only one of the phenomena of menstruation, and the most variable of all, being of longer or shorter duration, and more or less profuse, at different times, owing to general or local causes, it seems to me preferable to make our calculation from the middle of one catamenia to the middle of the next. I have, accordingly, adopted this course in computing the length of the cycles in the forego-

*De Boismont: *De La Menstruation*, page 119, et seq. Robertson, *Edinburgh Medical and Surgical Journal*, vol. xxxiii.

†These records are omitted.—Editors.

ing cases. Whenever an interval has occurred, approximately equal to two or more periods, I have considered it as consisting of so many cycles, in obtaining an average. Also, when discharges of blood are noted at short intervals, I have on one or two occasions taken the second as indicating the termination of the cycle. Attention is called to such instances by an asterisk. In several cases I have refrained from deducing an average on account of excessive irregularity, as in No. 4, where forty-three days might be accepted as embracing two cycles, but I should then be left in doubt as to the next period of thirty-one days.

LENGTH OF THE MENSTRUAL CYCLES IN DAYS.

With an abstract from the description of each subject, which was omitted in the original publication.

- No. 1—23, 25, 29, 50,* 31. Six cycles . . . Mean, $26\frac{1}{3}$ days.
Age, 13 years; virgin; delicate; strumous family.
- No. 2—24, 24, 24, 23, 24, 23, 24, 26 Mean, 24 days.
Age, 18 years; virgin; epileptic attacks at long intervals; health perfect in other respects.
- No. 3—29, 34, 31, 33, 31 Mean, $31\frac{3}{5}$ days.
Age, 22 years; virgin; healthy.
- No. 4—23, 23, 23, 20, 22, 23, 23 Mean, $22\frac{3}{7}$ days.
Age, 20 years; virgin; perfectly healthy.
- No. 5—25, 22, 24, 43, 31
Age, 17 years; perfectly healthy.
- No. 6—28, 28, 27, 34, 21 Mean, $27\frac{3}{5}$ days.
Age, 16 years; virgin; healthy.
- No. 7—24, 26, 30, 24, 34, 26, 26, 31, 23, 25, 25, 26, Mean, $26\frac{2}{3}$ days.
Age, 25 years; virgin; delicate; epileptic.
- No. 8—25, 24, 25, 25, 22, 23, 24 Mean, 24 days.
Age, 28 years; virgin; dyspepsia; pain in the ovarian and uterine region; leucorrhea.
- No. 9—29, 33, 28, 26, 27, 26 Mean, $28\frac{1}{6}$ days.
Age, 24 years; virgin; exceedingly delicate; hysterical; anemic.
- No. 10—26, 27, 26, 26, 29, 24 Mean, $26\frac{1}{3}$ days.
Age, 22 years; mulatto; malarial neuralgia; leucorrhea.

- No. 11—26, 17, 24, 26, 28, 23, 26, 28, 28. Mean, $26\frac{2}{9}$ days.
Age, 26 years; virgin; leucorrhœa; disorder of digestive organs, with frequent attacks of diarrhœa.
- No. 12—27, 24, 27, 25, 27 Mean 26 days.
Age, 24 years; virgin; anteflexion; painful menstruation; dyspepsia; hysteria.
- No. 13—27, 28, 27, 16,* 13,* 55.* Six cycles . Mean, $27\frac{2}{3}$ days.
Age, 23 years; virgin; dyspepsia; anæmia; painful menstruation; anteversion.
- No. 14—34, 35, 33, 38 Mean, $32\frac{1}{2}$ days.
Age, 25 years; virgin; retroversion; anæmia; dyspepsia.
- No. 15—25, 29, 30, 27, 24 Mean, 27 days.
Age, 20 years; virgin; delicate; dyspepsia; anteversion, with enlargement of right ovary.
- No. 16—21, 35, 28, 29, 29, 28, 30 Mean, $28\frac{4}{7}$ days.
Age, 22 years; healthy; recently married.
- No. 17—29, 23, 25, 29, 32, 26. Mean, $27\frac{1}{3}$ days.
Age, 30 years; twice married; sterile; general health good; no uterine symptoms.
- No. 18—29, 29, 31, 26, 29, 28. Mean, $28\frac{2}{3}$ days.
Age, 23 years; married; sterile; painful menstruation; contracted and tortuous cervical canal.
- No. 19—28, 27, 27, 31, 26, 28. Mean, $27\frac{7}{8}$ days.
Age, 29 years; married; sterile; slender and of delicate appearance, but general health good; menstruation scant and sometimes painful; no uterine disease except slight anteflexion.
- No. 20—29, 30, 31, 31, 27, 32, 26 Mean, $29\frac{3}{7}$ days.
Age, 30 years; married; sterile; has been treated for metritis and apparently cured; large; robust and healthy; addicted to the use of opium.
- No. 21—28, 30, 27, 26, 26, 27, 26, 23, 27, 27, 25, 26. Mean, $26\frac{1}{2}$ days.
Age, 29 years; married; sterile; anæmic; emaciated; feeble; great dysmenorrhœa; body of uterus not larger than a walnut.
- No. 22—24, 24, 23, 25, 25, 26, 26. Mean, $24\frac{5}{7}$ days.
Age, 42 years; married; has had a fibroid tumor removed from cervix; still has some symptoms of uterine trouble; general health good.

- No. 23—29, 26, 31, 30, 28, 28. Mean, $28\frac{2}{3}$ days.
Age, 37 years; married; sterile; anteversion;
general health good.
- No. 24—25, 25, 44, 27, 27, 26, 25, 31.
Age, 36 years; married; sterile; endocervicitis;
general health good.
- No. 25—29, 26, 29, 28, 26, 31, 25 Mean, $27\frac{5}{7}$ days.
Age, 37 years; married; sterile; retroversion;
general health good.
- No. 26—26, 37, 23, 19, 53, 27, 25
Same as No. 24.
- No. 27—31, 32, 40, 34, 41, 33, 31 Mean, $34\frac{4}{7}$ days.
Age, 27 years; married; sterile; general health
fair.
- No. 28—27, 32, 21, 20, 24, 27, 24 Mean, 25 days.
Age, 27 years; has had four children all of whom
have died soon after birth; very delicate;
cervical inflammation; strumous family.
- No. 29—35, 34, 32, 41 Mean, $35\frac{1}{2}$ days.
Age, 38 years; three children and two miscar-
riages; uterus much enlarged; sensitive and
anteverted; no leucorrhœa; hyperæsthesia
of clitoris and vulva; fleshy.
- No. 30—23, 27, 44, 29, 28.
Age, 44 years; eight children; retroversion of
long standing; dyspepsia.
- No. 31—27, 27, 29, 31, 25, 27, 28 Mean, $27\frac{5}{7}$ days.
Age, 25 years; two children and two miscar-
riages; endocervicitis; incipient phthisis.
- No. 32—28, 27, 26, 25, 8, 7.
Age, 22 years; one child; retroversion.
- No. 33—25, 44, 30, 32, 39 Mean, 34 days.
Age, 21 years; one child; this record begins
with the first menstrual period after its birth;
subinvolution.
- No. 34—28, 26, 26, 28, 28, 28 Mean, $27\frac{1}{3}$ days.
Age, 35 years; six children; very delicate; tend-
ency to phthisis suspected; no uterine dis-
ease.
- No. 35—28, 27, 26, 33, 24 Mean, $27\frac{3}{5}$ days.
Age, 30 years; three children; healthy.
- No. 36—26, 28, 28, 17, 25, 28, 34, 26
Age, 32 years; two children; corporeal metritis;
hemorrhages; apparently cured before these
records commenced.

No. 37—32, 27, 30, 37, 31, 30. Mean, $31\frac{1}{6}$ days.

Age, 26 years; one child; dyspeptic and of delicate appearance; uterus enlarged and anteverted.

No. 38—30, 29, 31, 31, 29, 29, 31 Mean, 30 days.

Age, 21 years; one child; healthy.

No. 39—28

Conception; labor in 286 days from the beginning of the last period.

No. 40—28, 28.

Conception; 56 days after the middle of the last period (exactly two cycles) she had hemorrhage. Labor 278 days from the beginning last period. Menstruation recurred 70 days afterwards, 27, 31, 29, 26, 28, 29, 29, 27 . Mean, $28\frac{1}{4}$ days.

No. 41—15*, 37, 27, 26, 30, 27, 31, 24 Mean, $28\frac{6}{7}$ days.

Conception; labor 285 days after the beginning of the last period.

I must confess that I was somewhat surprised when these reports began to accumulate. Many of the individuals had declared to me that they were perfectly regular, and there can be no doubt that they conscientiously believed themselves to be so. Several told me that their sickness came every twenty-eight days; some every thirty days, and others every three weeks, and that they could predict it almost to the hour. This shows how little reliance can be placed upon the unaided memory in such matters; and I would insist that no statements with reference to the periodicity of menstruation be accepted, unless the account has been carefully kept in writing. I shall endeavor to act in accordance with this principle myself, and although I have many convictions drawn from general impressions and unrecorded observations, I shall confine my present effort to an examination of the evidence afforded by the above cases, and not attempt to establish any proposition, except in so far as it is sustained thereby.

A casual inspection of the above records is sufficient to satisfy the mind on several points. In the first place, it is manifest that the menstrual cycle is exceedingly variable, not only when we compare the cycles of different women, but, also, when those of the same woman are compared with each other. Secondly, though the cycles are inconstant in each case, yet in some women they seem to revolve, habitually, in shorter periods than they do in others; in No. 4, for example, the average of seven cycles is only 22 3-7 days, and in No. 29, the average of four cycles is 35 1-2 days. And, lastly, the length of the cycles does not bear any fixed relation to the age of the individual; in cases No. 4 and No. 33 we have a difference of only one year in age, but the average length of the cycles in the latter is nearly twelve days greater than it is in the former. I can not help believing that some diseases modify both the length and uniformity of the cycles; but what are these diseases; in what way do they act, and to what extent? are questions upon which these observations throw no light. It is certain that great irregularity in the periodic return of menstruation is perfectly compatible with apparent health. The subject of case No. 5, for instance, is one of the healthiest and most robust girls of my acquaintance. On the other hand, a woman may be emaciated and debilitated to an extreme degree (Case 21) by painful disease, and the monthly discharge reduced to a pinkish stain, yet as long as menstruation continues it may take place according to its usual rhythm. Holding the opinion which I do as to the origin of the menstrual cycle, I should look to morbid conditions of the sympathetic system for the disturbing influences of this kind.

Let us, in the next place, subject the records to a more critical analysis. I find it difficult to divest my mind of the time-honored notion that there is a definite time in which nature designs that the menstrual cycle shall be accomplished under perfectly physiological conditions, and it is certain that we can not otherwise determine the period, or even approximate to it.

The total number of cycles is 267. In the following table they are collated so as to exhibit the comparative frequency of the different periods. The first, third and fifth rows of figures indicate days, the alternate ones the number of cycles that correspond therewith. I have here considered all the intervals as cycles, without any distinction between single cycles, double cycles, etc. :

DAYS.	CYCLES.	DAYS.	CYCLES.	DAYS.	CYCLES.
7	1	24	20	35	2
8	1	25	22	37	3
13	1	26	36	39	1
15	1	27	32	40	1
16	1	28	32	41	2
17	2	29	24	42	1
19	1	30	11	44	3
20	2	31	22	50	1
21	3	32	7	53	1
22	3	33	4	55	1
23	16	34	7		

It would thus appear that the greatest number of cycles occupy 26 days, but the difference between this and 27 and 28 days is so slight, that the subtraction or addition of a single case might alter their relative positions. The frequency begins to increase at 20 days and terminates at 35 days, making 28 days intermediate between the two extremes, but there are one-third more cycles between 20 and 28 days, than there are between 28 and 35 days, so that, having in view the number of cycles, the intermediate point would fall between 26 and 27 days. The menstrual

discharge is here accepted as evidence of the revolution of the cycle, since there is no other way in which this can be ascertained, but this being an exceedingly variable symptom, it leaves the method open to several sources of fallacy. One of these has been pointed out, and is partially obviated by making our calculations from the middle of the time occupied by each flow; others are yet to be considered. It frequently happens that the menstrual discharge is precipitated a day or two in advance of its proper time (see Case 23) by some accident, such as mental emotion, local irritation, bodily exertion, ect.; or such causes coming into action toward its close, the flow may be prolonged; in either event, the middle of the hemorrhage would not mark the termination of the cycle. Again, the discharge may last on one occasion an odd number of days, and on the next, an even number, when it would be impossible to indicate the length of the cycle, without resorting to the use of fractions of a day. Errors arising from both of these sources may, to a certain extent, be corrected by taking the mean length of the cycles in each case. This I have done in every instance where the cycles are at all uniform, and an examination of the figures shows that the largest number of averages falls between 27 and 28 days. Omitting all intervals of more than 30 or less than 20 days, which may be considered as beyond the range of normal cycles, the remainder will give a mean of 27 1-3 days. From all of this, I do not feel authorized to draw any positive conclusion; at most, it is simply sufficient to indicate, that if there is a physiological standard for the menstrual cycle, its duration must be a fraction less than 28 days.

An impression prevails that hemorrhage from the uterus from any fortuitous cause, such as mental excitement or mechanical violence, may take the place of the menstrual hemorrhage, and that the next period may be expected after the normal interval, counting from that time, rather than from the last regular period. Tilt speaks of this and uses it as an argument against the Ovular Theory. Among the above cases there are several which bear upon this point. In Nos. 21 and 23, hemorrhage was caused by the application of irritants to the cavity of the womb, and in No. 36, by an acute inflammation of the bowels, without affecting the regularity of menstruation. I believe the menstrual cycle to be independent of conditions of the uterus, except as these may, by slow degrees, react upon and derange the ganglionic system. That it sometimes runs a rapid course, or is brought to a precipitate termination, is shown by cases 11 and 36, but in neither of these instances could any cause for the early appearance of menstruation be assigned.

I have subjected these records to the closest scrutiny with the hope of detecting some rules, as to time, by which the length of the cycles varies when menstruation takes place at irregular or unusual intervals, but with negative results. According to one theory, which has been very ably advocated, all the periodic phenomena displayed in the human economy have a common origin, and are governed by the same fundamental laws; the menstrual cycle of twenty-eight days being a multiple of four minor cycles of seven days each, which correspond with the seven day periods of malarial fevers. A very serious objection to this, is that, although I have tried very hard

to do so, I have failed to establish twenty-eight days as the standard length of the menstrual cycle; but admitting that it is, and that I have not succeeded, simply in consequence of having been unfortunate in my selection of cases, then certainly among so many, and such irregular cases, we should expect to see the minor cycles declare themselves with some degree of frequency. The evidence of anything of this kind is very slight, and, it must be confessed, can only be found by a special search. In No. 13, in which the average duration of the cycles is 27 4-6 days, there is one period of 16 days followed by another of 13 days, which looks like a rude effort at halving the complete cycle; and in No. 32 there is one of 8 and one of 7 days, which is an approximation to quartering it. In the whole list of 267 cycles, there is not one of 14 days, and only three of 21 days. I am not prepared at present to reject this theory as positively erroneous, but must have more satisfactory proof of its validity before I can accept it. That the periodicity of menstruation is one of the same nature, and due to the same causes as the periodicity of agues, is certainly a mistake, in view of the absence in the former of that precision which is so notable a characteristic of the latter.

It is a matter of importance, practically, as well as theoretically, to discover the chronological rules, according to which menstruation reappears, when once suppressed. The belief is general that when a woman, who has been comparatively regular, goes a week or so over her usual time, she need not look for it until the arrival of the next menstrual epoch. Among the cases herein reported there are only two (Nos. 1 and 3) which can be cited as corroborative of

this opinion. In a number of others (Nos. 5, 22, 28, 31 and 33) menstruation recurred at various periods exceeding one, but less two cycles. This seems to afford an intimation of two different forms of suppression; in the first the menstrual cycle progresses in a natural manner, but fails at its culminating point to affect the vascular apparatus of the generative organs in such a way as to produce engorgement and hemorrhage; in the second, the physiological steps of the cycle are retarded, or possibly altogether suspended for a time. If this suggestion prove correct, as I think it will, the discrimination between these two forms may become a valuable means of diagnosis, especially in those diseases of women which involve the ganglionic nervous system.

Are the menstrual cycles arrested by pregnancy? They are not. It has long been known that a woman is more liable to abort at what would have been a menstrual epoch, had she not conceived, than at other times, and this, together with the frequent coincidence of the advent of labor with the termination of the tenth menstrual cycle, has led some physiologists to regard the *nisus* occurring at this time, as the principal if not the sole excitant of uterine contractions; but such an interpretation of the facts was in contravention of the Ovular Theory, and consequently has not been accepted. Of this view of the cause of labor, Playfair remarks: "It assumes that the periodic changes in the ovary continue during pregnancy, of which there is no proof. Indeed, there is good reason to believe that ovulation is suspended during gestation, and with it, of course, the menstrual *nisus*. Besides, as has been well objected by Cazeaux, even if this theory were admitted, it would still leave the

mystery unsolved, for it would not explain why the menstrual nismus should act in this way at the tenth menstrual epoch rather than the ninth or the eleventh." Playfair evidently views the subject by the light of the Ovular Theory. No one can deny that there are indications of the menstrual periodicity in pregnancy, sometimes, even, menstruation itself;* and since Playfair can not explain well attested facts, or make them bend to suit his own tenets, he ignores them. I do not "assume that the periodic changes in the ovary continue during pregnancy;" on the contrary, I deny that there are any such changes, except as the result of a special cyclical action on the part of the ganglionic nervous system, which is not arrested, but simply modified by conception. The objection of Cazeaux is in reply to Tyler Smith, who unfortunately assumes too much. The latter contended that the menstrual nismus (or, as he termed it, the ovarian nismus) returns in a slight degree, at each periodic date, throughout pregnancy, "until the tenth period, when it resumes its full force, and, as a consequence, the uterine excitability and the uterine actions of labor begin." Of the correctness of this last assertion, no proof can be furnished.

I am rather disposed to adopt the explanation of Rigby, in a somewhat modified form, according to which the menstrual nismus constitutes only one of the factors in determining labor. About the thirty-eighth week of utero-gestation a number of influences begin to co-operate and predispose the uterus to take on expulsive efforts; such as the perfect development and increased tonicity of its muscular fibres, extreme distention of its cavity, irritation of the cervix by the

**Vide* Duncan's *Researches on Obstetrics*, page 170.

inferior segment of the ovum, fatty degeneration of the decidua, changes in the fetal circulation, etc. These would finally act with sufficient intensity to bring on labor, but before this degree is reached the closing stage of a cycle generally arrives, it may be of the ninth or of the eleventh (according to the length of the cycles), but most frequently of the tenth, and the event is precipitated. In this way the menstrual *nisus* serves to render the term of gestation more definite than it otherwise would be. Case No. 38 tends to confirm these views. Here the cycles were uniformly about 28 days in length; on the 56th day, exactly at the close of the second cycle, there was hemorrhage, accompanied by other symptoms of miscarriage, and labor supervened on the 278th day, at the close of the tenth cycle.

But how should we apply these principles to cases in which menstruation has been very irregular, or in which there is a decided departure from the twenty-eight day type? I have used the word *Nisus*, to indicate the acme or culminating point of the perturbations which accompany and depend upon the progress of the menstrual cycle, the attainment of which is usually denoted by hemorrhage from the cavity of the uterus. It must not be supposed, however, that there is at this time any sudden explosion of nervous energy, followed by an equally rapid subsidence. Recent examinations of the mucous membrane of the uterus, with reference to its relations to menstruation, have shown that it can hardly ever be said to be in a state of perfect vascular and structural repose, but, for the most part, evinces signs of the alternate ebb and flow of innervation; congestion and nutritive changes gradually increase as the cyclical wave advances, and

then as gradually subside as it recedes. Engelmann, in one of the most instructive articles I have ever read, speaks as follows on this subject:

“Anatomical experience, as I will show, does not bear out the assumption which, theoretically, appears well-founded, that the menstrual changes of the mucous membrane, just described, come and go as rapidly as the menstrual period itself.”

Again: “We rarely find a completely normal inactive uterine mucosa, which seems to indicate that the actual period of rest for that membrane is much shorter than is generally assumed.”

Since the nervous impulse of the menstrual cycle affects the nutrition and circulation of the non-gravid uterus in the manner indicated, it is reasonable to infer that, in the event of its being perpetuated throughout pregnancy, it would continue to affect the gravid organ in a similar way, though it certainly does not do so to the same extent; and the changes thus induced would exercise a disturbing influence over the progress of gestation; this influence is augmented as the cycle advances, until the *nisus* is reached, when it gradually abates. If in any pregnancy a predisposition to abortion or labor exists in a slight degree, the full forces of the disturbing influence exerted at the *nisus* will be necessary to bring on uterine contractions; but if the predisposing cause is energetic, expulsive action will be excited during the increment of the cycle, before the *nisus* is attained. For the sake of illustration, suppose conception to happen in a case similar to No. 4, in which the cycles, though uniform, are short; the revolution of ten cycles would be accomplished in 224 days, which would be too early for the predisposing causes of labor to have

come into play, consequently the nusus of the tenth cycle could have no effect, and pregnancy would continue until the termination of the twelfth, about the 271st day. In a case like No. 41, the periods are so irregular that it would be impossible to determine accurately as to the cycles in pregnancy; our only alternative would be to ascertain the mean duration of a number of cycles, and make our calculations from this. Here the mean of seven cycles is 28 6-7 days. Nine cycles of this length are equal to 260 days, but we should scarcely expect labor to be induced so soon. Ten cycles would be equivalent to 288 days, by which time the predisposing causes of labor have usually become very powerful; and it is exceedingly probable that the disturbing influences of the advancing tenth cycle would be sufficient to stimulate the uterus into action, before they had reached the point of greatest intensity, that is, before the nusus was achieved. Accordingly, we find in the case in question that labor took place on the 285th day.

Of the reports collected since this article was published, the following may be relied upon:

No. 42—26, 25, 25, 27, 25, 28, 26, 26. Mean, 26 days.
Age, 27 years; virgin; healthy, but of strumous family.

No. 43—25, 25, 25, 25, 36, 26, 32, 30, 28, 29, 30, 33. Mean, $28\frac{2}{3}$ days.
Age, 20 years; virgin; healthy, but not robust; slight menstrual goitre.

No. 44—24, 23, 36, 21, 55, 24, 31, 30. Mean, $30\frac{1}{2}$ days.
Age, 26 years; married; healthy; sterile; no cause of sterility can be detected upon a most careful examination of genital organs.

No. 45—23, 24, 22, 25, 22, 27, 22, 26, 25, 24. Mean, 24 days.
Age, 28 years; virgin; suffers from dyspepsia, but is quite fleshy; leucorrhœa.

No. 46—30, 29, 28, 29, 27, 28, 28, 27, 28, 29, 28. Mean, $28\frac{1}{4}$ days.
Age, 21 years; virgin; healthy.

No. 47—53*, 36, 29, 30. Mean, $29\frac{3}{8}$ days.
Age, 20 years; virgin; healthy.

No. 48—24, 26, 26, 28, 28, 27. Mean, $26\frac{1}{2}$ days.
Age, 18 years; single; fleshy; vaginal leucorrhœa.

No. 49—27, 24, 27, 27, 25, 23, 25, 27, 26, 28, 27, 24, 26. Mean, $25\frac{5}{6}$ days.
Age, 19 years; virgin; healthy.

No. 50—36, 23, 26, 26, 30, 35, 16, 31, 27, 18, 36,
25, 26, 24, 26, 23, 26, 25, 26. Mean, $26\frac{1}{2}$ days.
Age, 30 years; mother of two children; general health good, but suffers from back ache and the usual symptoms accompanying endocervicitis, with free secretion of ropy mucus.

No. 51—27, 28, 23, 27, 27, 25, 13*, 12*, 24, 30, 23. Mean, 26 days.
Age, 30 years; mother of one child; general health good, but of very spare habit, and of strumous family; vaginitis, with free purulent leucorrhœa.

No. 52—28, 33, 35, 30, 32, 29. Mean, $31\frac{1}{6}$ days.
Age, 26 years; married; sterile; uterus apparently healthy.

No. 53—26, 29, 27, 29, 30, 30, 33, 28, 29, 28, 34, 31, 28. Mean, $29\frac{1}{2}$ days.
Age, 32 years; married; sterile; general health bad; goitre; retroversion.

No. 54—27, 27, 23, 26. Mean $25\frac{3}{7}$ days.
Age, 25 years; recently married; healthy.

No. 55—26, 26, 26, 51*, 30, 22, 27, 25, 30, 50*, 21. Mean, $25\frac{3}{4}$ days.
Age, 26 years; married; sterile; delicate; anti-flexion; distressing irritability of bladder.

No. 56—29, 26, 26, 26, 28, 26, 27. Mean, 28 days.
Age, 30 years; three children; very spare, though healthy.

No. 57—26, 24, 26, 26, 25. Mean, $25\frac{2}{5}$ days.
Age, 37 years; one child; corpulent; phleg-

masia dolens in left leg after labor seven years ago; eight or ten days before menstruation she suffers pain in this limb, which subsides upon the establishment of the flow.

No. 58—30, 28, 26, 27, 26, 33, 24, 32, 29, 27, 37, 19. Mean, 29 days.

Age, 26 years; married; healthy; sterile; remarkable tortuosity of cervical canal, with enlargement of body of uterus.

No. 59—34, 20, 17, 23, 21, 31, 35, 27, 24, 24, 23, 40, 16, 23, 12, 38, 22, 24, 23, 22, 10, 19, 19, 25, 19, 21, 36, 57, 19, 13, 46, 26, 24, 21, 28, 35, 43, 43, 26, 122, 16, 27, 62, 25, 30, 16, 30, 28, 84

Age, 34 years when this record began; multipara; perfectly healthy.

No. 60—30, 38, 31, 21, 28, 26, 39, 23, 27, 27, 31, 27. Mean, 28 days.

Age, 28 years; virgin; general health good; retroversion.

No. 61—25, 27, 27, 26, 26, 27, 18, 8, 34, 21, 27, 25, 23, 26, 25, 26, 27, 23, 23, 32, 13, 27, 28, 24, 27, 56, 23, 27, 23, 27, 32, 30, 27.

Age, 45 years when this record commenced; multipara; perfectly healthy; ceased to menstruate at 50 years of age.

No. 62—13, 31, 18, 43, 16, 24, 7.

Age, 44 years; married; sterile; healthy.

No. 63—23, 25, 27 Mean, 25 days.

Conception; labor 284 days after beginning of last menstrual period.

No. 64—25, 26, 25, 24, 24, 26, 25, 24. Mean, $24\frac{7}{8}$ days.

Age, 28 years; recently married; corpulent; healthy.

No. 65—23, 25, 25, 35, 24, 26, 27, 26, 28. Mean, $26\frac{6}{7}$ days.

Age, 26 years; recently married; of an exceedingly delicate, nervous organization.

No. 66—34, 40, 23, 35.

During lactation, conception; second pregnancy; labor in 271 days after beginning of last menstrual period.

No. 67—50, 47, 44, 29, 29, 29

During lactation, conception; second pregnancy; labor in 288 days after beginning of last menstrual period.



The general mean of these cases is 27 3-13 days. Upon combining them with the former list, and tabulating them, we have the following result:

Days.	Cycles	Days.	Cycles	Days.	Cycles	Days.	Cycles
7	2	22	9	37	4	52	2
8	2	23	36	38	2	53	
9		24	41	39	2	54	
10	1	25	48	40	3	55	3
11		26	77	41	2	56	1
12	2	27	70	42	1	57	1
13	5	28	53	43	3	58	
14		29	45	44	4	59	
15	1	30	27	45		60	
16	6	31	29	46	1	61	
17	3	32	12	47	1	62	1
18	3	33	10	48		84	1
19	6	34	11	49		287	1
20	3	35	8	50	4		
21	10	36	6	51	1		

NATIONAL LIBRARY OF MEDICINE



NLM 00555649 2